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In this issue: Road-user and property taxes on selected vehicles
(New Jersey State Route 1 in Jersey City)

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U. S. DEPARTMENT OF COMMERCE
SINCLAIR WEEKS, Secretary

BUREAU OF PUBLIC ROADS
THOMAS H. MacDONALD, Commissioner

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Road-User and Property Taxes on Selected Motor Vehicles, 1953

BY THE RESEARCH REPORTS BRANCH
BUREAU OF PUBLIC ROADS

Reported by EDWIN M. COPE, Chief
Highway Statistics Section,
and RICHARD W. MEADOWS,
Transportation Economist

Faced with the need to find additional funds for the necessary acceleration of the highway improvement program, administrators, economists, and engineers are studying all available and prospective sources of highway revenue. Highway finance theories all seek a common aim—the equitable levying of costs, through taxation or other means, on those who use and benefit from our roads and streets.

The need for basic factual information in such studies is self-evident. In this article are presented data, by States, on the State road-user imposts—registration fees and motor-fuel taxes—which furnish the bulk of the current income for highways. Since direct property taxes levied on motor vehicles in many States are an important part of the cost of vehicle ownership and operation, data on these taxes are included even though they are not collected as highway revenue. For purposes of comparison, information is reported separately for some of the commercial vehicles according to their use in private operation, farm service, or contract hauling.

The data are reported for eleven typical vehicles, operating under uniform assumed conditions, with tax rates effective on January 1, 1953. Comparisons can thus be made of the taxes paid for similar vehicles in different States, for different types of vehicles in the same State, and for a particular vehicle in different types of operation.

The ranges found are extensive, varying in total amount paid annually from $20 to $4,475. The national average for a farm pickup truck is only $44 a year (less than for a light passenger car), while for a six-axle diesel combination in contract operation it is more than $3,000. Annual taxes on a stake truck average $75 if in farm service, $140 in private use, and $230 in contract hauling operation. A three-axle combination in private use, on the average, pays $256 in registration fees, $422 in motor-fuel tax, and $164 in property tax.

TODAY there are 44 million automobiles and more than 9 million trucks and busses on the highways—53 million vehicles, a total undreamed of 10 years ago. Partly as a result of the great increases in the number of vehicles and partly because of enforced neglect of our highways during the war years and difficulties encountered since, public authorities, legislatures, and highway-user groups are engaged in a desperate effort to accelerate the highway improvement program. The most pressing problem faced is that of finding the necessary funds. A considerable amount of study has been given to highway finance theories—the increment theory, the theory of ability to pay, the cost and the value of the service, and the portion that should be attributed to defense. As a preliminary to any work in tax theory, there is need for measurement of the amounts already being collected under existing tax rates. In the search for revenue, full consideration must be given to the burden of all direct taxes, including property taxes, on the vehicle owner.

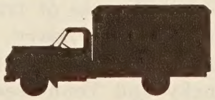
The principal current State road-user revenues are derived from the gasoline tax and from registration fees on motor vehicles, but in some States a relatively low gasoline tax is accompanied by above-average registration fees, while in others, higher gasoline taxes are accompanied by low registration fees. In Alabama an automobile can be registered for $3.00 and the gasoline tax rate is 6 cents; in New York State it costs five times as much to register the same automobile but the gasoline tax is only 4 cents. The result is that the road-user taxes are about the same on that automobile in the two States.

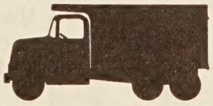
The purpose of this study is to provide data that make it possible to compare the total direct State and personal-property taxes on the road user, as well as the yields from the individual levies. It supplies the needed tool of direct measurement of existing taxes, so that comparisons can be made between vehicles, between States, and between different services. This is accomplished through presentation of the amounts of State road-user taxes and all direct personal-property taxes that would be paid in each State (except Oregon) during one full year, at rates in effect January 1, 1953, for each of a group of vehicles that represent significant points in the tax range. The study is similar in many respects to the

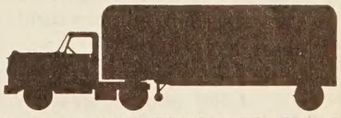
NOS. 1 & 2
PASSENGER CAR

NO. 3 - PICKUP

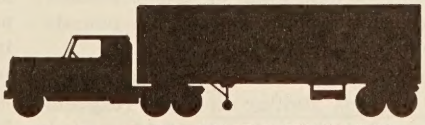
NO 4 - STAKE

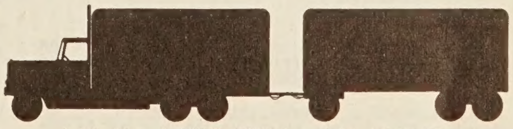

NO. 5 - VAN


NO. 6 - 3-AXLE DUMP


NO. 7 - 3-AXLE TRACTOR-SEMITRAILER

NOS 8 & 9 - 4-AXLE TRACTOR-SEMITRAILER


NO 10 - 5-AXLE TRACTOR-SEMITRAILER


NO. 11 - 6-AXLE TRUCK - FULL TRAILER

one presented for 1950 in PUBLIC ROADS.[1] The 1953 information is summarized or illustrated in tables, bar charts, and maps. The presentations are intended to be self-explanatory and not every one is discussed in detail in the text.

The absence of data for Oregon is a regrettable deficiency. At the time the study was being prepared, the Oregon weight-distance tax was subject to popular referendum in the November 4, 1952, general election, and even if approved would have been invalidated by the approval of a constitutional amendment appearing on the same ballot.[2] Since the imposition of the Oregon weight-distance law was contingent upon both of these pending actions, and could have been invalidated by the outcome of either, data for the State were not included. Consequently, where the phrase "all States" is used, it includes the District of Columbia (in order to avoid the necessity of naming it separately) and all States except Oregon. The absence of Oregon data obviously affects the ranking of States according to total taxes that would be paid on specific vehicles under the prescribed conditions. If it had been possible to include data for Oregon, the ranking of taxes for most of the heavier vehicles would have been affected for all or nearly all States, particularly for vehicles in private, not-for-hire operation.

The Typical Vehicles

The bases for registering motor vehicles vary considerably among the States. As shown in table 1 (p. 129), passenger cars are registered in some States on a flat fee basis, with no regard for other factors. In Mississippi, at the other extreme, a flat fee rate is also in effect but is compounded by consideration of horsepower, gross weight, and vehicle age. The variations in registration bases are shown for passenger cars in figure 1, and for trucks in figure 2 (p. 130). State gasoline tax rates are represented in figure 3 (p. 130).

Eleven vehicles that are reasonably representative of the types and sizes that comprise the vehicle population were selected for the study—two passenger cars, four single-unit trucks, and five combinations. Their relative sizes and axle arrangements are shown in silhouette on page 127. Brief descriptions of the vehicles follow.

PASSENGER CARS:

No. 1.—A light-weight club coupe.

No. 2.—A medium-weight sedan.

SINGLE-UNIT TRUCKS:

No. 3.—A pickup truck registered for 4,700 pounds gross vehicle weight (commonly called a "½-ton" truck).

No. 4.—A stake truck registered for 12,500 pounds gross vehicle weight (commonly called a "1½-ton" truck).

No. 5.—A van registered for 19,000 pounds gross vehicle weight (commonly called a "2¾-ton" truck).

No. 6.—A tandem-axle dump truck registered for 40,000 pounds gross vehicle weight, of the type used in hauling coal, building materials, etc.

COMBINATIONS:

No. 7.—A three-axle tractor-semitrailer registered for 40,000 pounds gross vehicle weight, chosen so that it falls within the maximum length and weight limits of all States.

No. 8.—A four-axle tractor-semitrailer (tandem axles on the semitrailer), gasoline powered, and registered for 50,000 pounds gross vehicle weight (No. 9 is the same vehicle, but with diesel power).

No. 9.—A four-axle tractor-semitrailer (tandem axles on the semitrailer), diesel powered, and registered for 50,000 pounds gross vehicle weight (No. 8 is the same vehicle, but with gasoline power).

No. 10.—A five-axle tractor-semitrailer (tandem axles on both units), registered for 64,000 pounds gross vehicle weight.

No. 11.—A six-axle truck and full trailer combination (tandem axles on both units), registered for 72,000 pounds gross vehicle weight.

The 40,000-pound combination (No. 7) would be permitted to register and operate in all States, but the 40,000-pound tandem-axle single-unit truck (No. 6) would not. Washington has a flat limitation of 36,000 pounds on a truck with three axles, and Mississippi has a limit of 37,650 pounds for such vehicles. Because of axle spacing and axle-load limits, the 40,000-pound single-unit truck is on the borderline of legality in some of the States with respect to registration and operation, but it has been included in order to show that point in the tax schedules. Although the 40,000-pound single-unit truck is found chiefly in specialized operations, the 40,000-pound three-axle combination is in almost universal use and is undoubtedly the most commonly found heavy unit.

Three States have size and weight limitations that prohibit the use of tractor-semitrailer combinations as heavy as 50,000 pounds, but all others permit them. The limit in Kentucky and Tennessee is 42,000 pounds for any combination and Pennsylvania permits a maximum of 45,000 pounds for tractor-semitrailers and 62,000 pounds for other combinations.

In order to present a comparison of the taxes on vehicles similar in most respects except type of fuel used, two 50,000-pound four-axle combinations are included in the study, one with a gasoline engine, the other with diesel power. The assumption made that the gasoline combination operates 4 miles to the gallon and that the fuel consumption rate of the diesel combination is 6 miles per gallon is arbitrary, but believed to be reasonable. It is recognized that the difference in the miles-per-gallon rates of two individual vehicles might fall substantially short of, or could exceed, the assumed 50-percent differential. (A 50-percent difference in consumption may also be expressed as a one-third saving in fuel.) It is of interest that New York also assumed a 50-percent differential in recently increasing the tax on diesel fuel from 4 cents to 6 cents per gallon.

The 64,000-pound combination (No. 10) selected is a five-axle, diesel-powered, tractor-semitrailer combination, 49 feet long, that can be operated in the Western States and a few Eastern States that are not contiguous, as shown in figure 5 (p. 131). The 64,000-pound combination in the 1950 study had a gasoline engine, but the growing popularity of diesel power for busses and heavy trucks dictated the selection of diesel power for both the 64,000-pound and the 72,000-pound combinations in the present study. The 72,000-pound truck and full trailer combination (No. 11) is permitted in Ohio, Louisiana, and all of the Western States. Ohio is the only State that permits vehicle No. 11 but prohibits vehicle No. 10 (see fig. 5). This is because of differences in the State's length limitations for the two types of combinations.

As shown in figure 6, tractor-semitrailer combinations are registered as single units in all 6 of the New England States, in 12 of the States in the Mississippi and Ohio River valleys, and in Virginia. In the remainder of the States, tractor-trucks and semitrailers are registered as separate units. Combinations are considered to be registered as single units where the fee for either the tractor or the semitrailer is based on the gross weight or capacity of the combination, even though in most of these States a relatively small fee is also levied on the other unit of the combination.

In some States the registration fee schedule is so established that from a tax standpoint it is more economical to operate a combination than a single-unit truck at a given gross vehicle weight. In Montana, for example, registration of a 40,000-pound single-unit truck costs $300.00, but the tractor and semitrailer components of a 40,000-pound combination, registered separately, cost only $92.50 in total.

The inclusion or exclusion of data for a given vehicle in each State was determined solely on the basis of whether the vehicle as specified would be permitted to register and operate. Numerous instances were found in which the vehicle or combination might be registered, but could not legally be operated with a full load. In New York, for instance, vehicle No. 10 could be registered

---

[1] *State road-user and personal-property taxes on selected motor vehicles, 1950*, by R. W. Meadows and S. F. Bielak. PUBLIC ROADS, vol. 26, No. 2, June 1950.

[2] In the election, Oregon voters approved the increased weight-distance taxes enacted into law by the 1951 State legislature.

Table 1.—Basis for registration of passenger cars

FLAT FEE:	EMPTY WEIGHT		SHIPPING WEIGHT	
Alabama Arizona California Idaho Kentucky Louisiana Nevada Ohio Oregon Pennsylvania Utah Virginia Washington Wisconsin Wyoming FLAT FEE AND AGE: Vermont	WEIGHT GROUPS: Connecticut Delaware Florida Maryland Montana North Carolina Tennessee Texas District of Columbia WEIGHT GROUPS AND HORSEPOWER: Indiana WEIGHT GROUPS AND AGE: North Dakota South Dakota	100-POUND INTERVALS: Colorado Michigan West Virginia 100-POUND INTERVALS AND AGE: New Mexico 100-POUND INTERVALS, VALUE AND AGE: Iowa 500-POUND INTERVALS: Georgia	WEIGHT GROUPS: Nebraska WEIGHT GROUPS AND AGE: Minnesota	100-POUND INTERVALS: New York 500-POUND INTERVALS: South Carolina
HORSEPOWER GROUPS:	GROSS WEIGHT		FACTORY DELIVERED PRICE AND AGE: Oklahoma	
Illinois Maine Massachusetts Missouri New Jersey	WEIGHT GROUPS: New Hampshire Rhode Island WEIGHT GROUPS AND HORSEPOWER: Arkansas	100-POUND INTERVALS: Kansas	FLAT FEE, HORSEPOWER, GROSS WEIGHT, AND AGE: Mississippi	

Table 2.—Data used in computing State road-user taxes and property taxes on selected vehicles, 1953 registration year

Factors affecting taxation	Passenger cars		Single-unit trucks				Tractor-semitrailer combinations								Truck and full trailer	
	No. 1: Light	No. 2: Medium	No. 3: Pickup	No. 4: Stake	No. 5: Van	No. 6: Dump	No. 7		No. 8 (gasoline)		No. 9 (diesel)		No. 10		No. 11	
							Tractor-truck	Semi-trailer	Tractor-truck	Semitrailer	Tractor-truck	Semitrailer	Tractor-truck	Semitrailer	Van truck	Full trailer
Body type	Club coupe, 6-pass.	Four-door, 6-pass.	Pickup	Stake	Van	Dump	Tractor	28-ft. van	Tractor	32-ft. van	Tractor	32-ft. van	Tractor	35-ft. van	Van	24-ft. van
Price, f.o.b. factory (1951)	$1,575	$2,148	$1,250	$1,784	$4,859	$11,270	$6,102	$4,400	$6,350	$6,862	$10,327	$6,931	$16,987	$7.000	$18,399	$7,500
Horsepower:																
N.A.C.C. (S.A.E.)	25.35	32.51	26.10	29.40	33.75	40.80	40.84	...	38.40	...	48.84	...	63.00	...	63.00	...
Maximum brake	97	124	95	92	137	147	155	...	135	...	150	...	165	...	200	...
Weight:																
Manufacturer's rated capacity ... tons	...	...	½	1½	2¾	...	...	...	...	...	...	...	...	...	...	...
Chassis weight ... pounds	...	...	...	4,135	6,425	12,675	...	...	...	...	...	...	...	...	17,800	...
Empty weight ... do	3,059	3,755	3,220	5,320	8,625	18,862	8,825	7,320	8,400	8,700	9,550	8,990	16,250	8,940	20,300	8,500
Load capacity ... do	...	...	1,480	7,180	10,375	21,138	13,175	10,680	15,600	17,300	15,450	16,010	19,750	19,060	15,700	27,500
Gross vehicle weight ... do	3,959	4,655	4,700	12,500	19,000	40,000	22,000	18,000	24,000	26,000	25,000	25,000	36,000	28,000	36,000	36,000
Gross weight of combination ... do	...	...	...	...	...	...	40,000	...	50,000	...	50,000	...	64,000	...	72,000	...
Length:																
Wheelbase ... inches	...	...	114	161	172	159–48½	141	...	136	...	134	...	169–50	...	210–52	176–52
Distance between tandem axles ... do	...	...	...	...	...	48½	...	...	...	48½	...	48½	50	48½	52	52
Length of combination ... feet	...	...	...	...	...	...	39	...	42	...	42	...	49	...	59	...
Tires:																
Size	...	...	6.50 x 16	7.50 x 20	8.25 x 20	10.00 x 20	10.00 x 20	10.00 x 20	10.00 x 20	10.00 x 20	10.00 x 20	10.00 x 20	10.00 x 20	10.00 x 20	10.00 x 22	10.00 x 22
Ply rating	...	...	6	8	10	12	12	12	12	12	12	12	14	14	12	12
Front arrangement	...	...	Single	Single	Single	Single	Single	...	Single	...	Single	...	Single	...	Single	Dual
Rear arrangement	...	...	Single	Dual	Dual	Dual-tandem	Dual	Dual	Dual	Dual-tandem	Dual	Dual-tandem	Dual-tandem	Dual-tandem	Dual-tandem	Dual-tandem
Total annual travel:																
Farm service ... miles	...	...	6,000	5,500	...	...	...	...	...	...	...	...	...	...	...	...
Private operation ... do	9,500	10,500	9,000	12,000	15,000	30,000	40,000	...	65,000	...	65,000	...	80,000	...	90,000	...
Contract carrier ... do	...	...	...	20,000	25,000	...	40,000	...	65,000	...	65.000	...	80,000	...	90,000	...
Average miles per gallon:																
Farm service	...	...	15.5	10.0	...	...	...	...	...	...	...	...	...	...	...	...
Private operation	16.5	14.5	15.0	9.0	6.5	4.0	5.0	...	4.0	...	6.0	...	4.7	...	4.3	...
Contract carrier	...	...	...	9.0	6.5	...	5.0	...	4.0	...	6.0	...	4.7	...	4.3	...
Annual motor-fuel consumption:																
Farm service ... gallons	...	...	387	550	...	...	...	...	...	...	...	...	...	...	...	...
Private operation ... do	576	724	600	1,333	2,307	7.500	8,000	...	16,250	...	10,833	...	17,021	...	20,930	...
Contract carrier ... do	...	...	...	2,222	3,846	...	8,000	...	16,250	...	10,833	...	17,021	...	20,930	...
Total revenue ton-miles (average load)	...	...	...	40,000	71,000	...	285,000	...	695,000	...	665,000	...	1.085,000	...	1,400,000	...
Average gross weight ... pounds	...	...	...	9,270	14,325	...	30,458	...	38,485	...	38,989	...	52,357	...	59.900	...
Gross annual earnings	...	...	...	$8,000	$11,500	...	$23,000	...	$52,000	...	$50,000	...	$78,000	...	$96,000	...

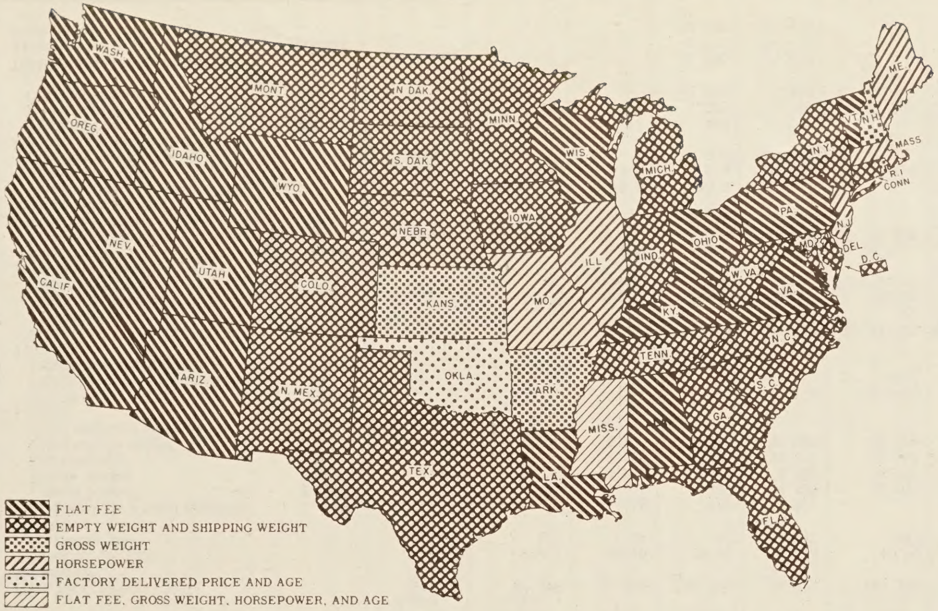


Figure 1.—Passenger-car registration fee basis.

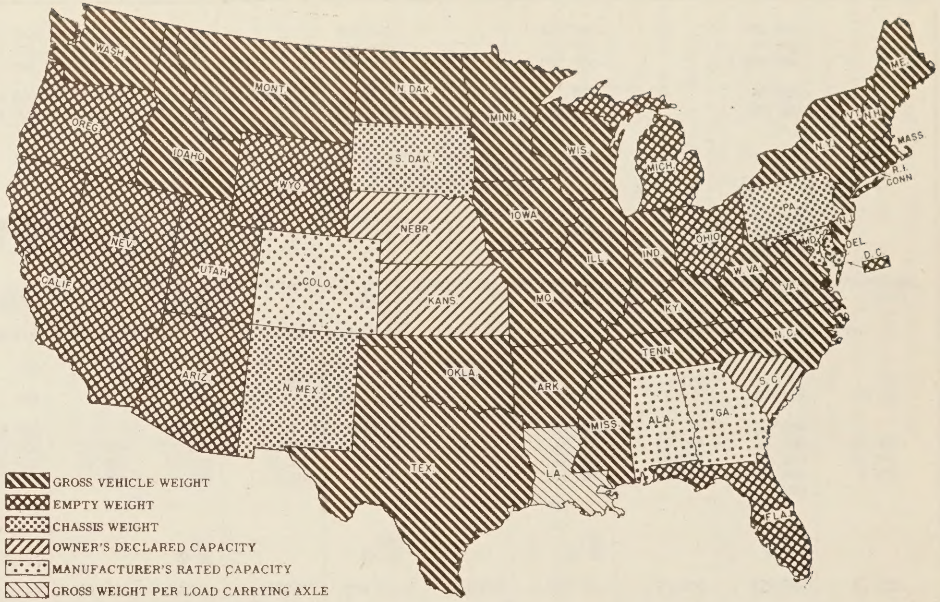


Figure 2.—Truck registration fee basis.

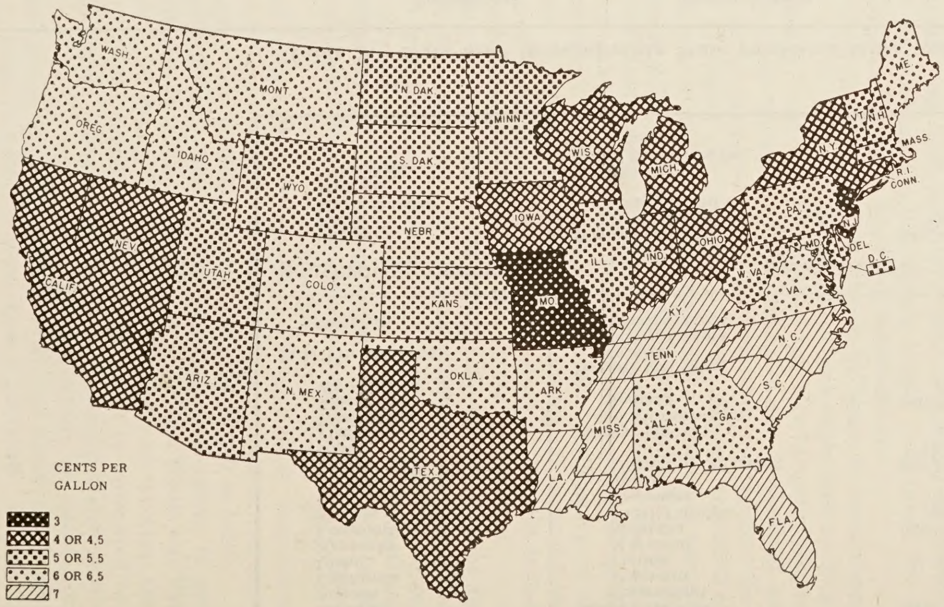
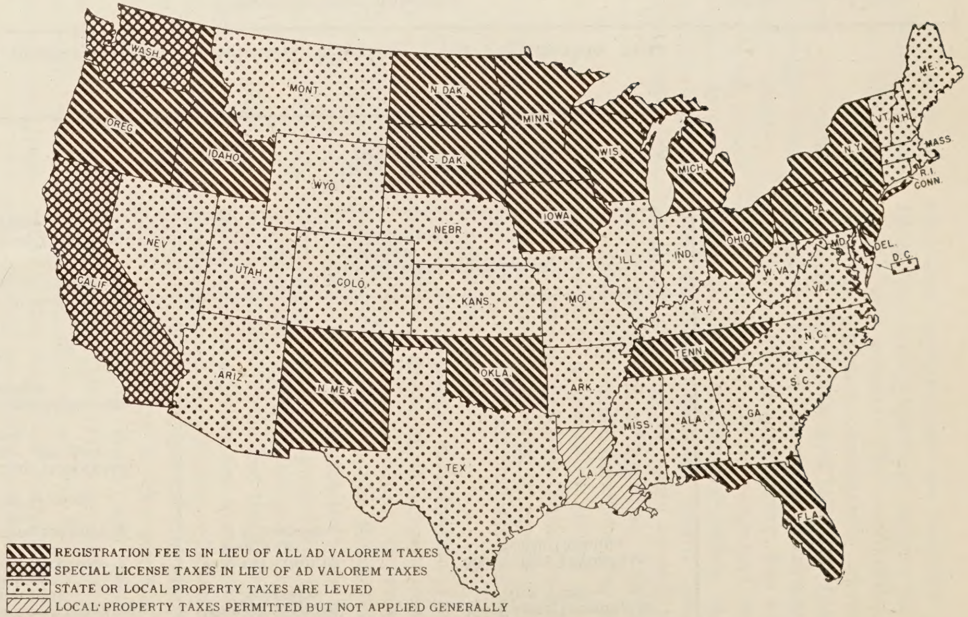


Figure 3.—State gasoline tax rates.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REGISTRATION FEE IS IN LIEU OF ALL AD VALOREM TAXES
SPECIAL LICENSE TAXES IN LIEU OF AD VALOREM TAXES
STATE OR LOCAL PROPERTY TAXES ARE LEVIED
LOCAL PROPERTY TAXES PERMITTED BUT NOT APPLIED GENERALLY

Figure 4.—Application of personal-property taxes to motor vehicles.

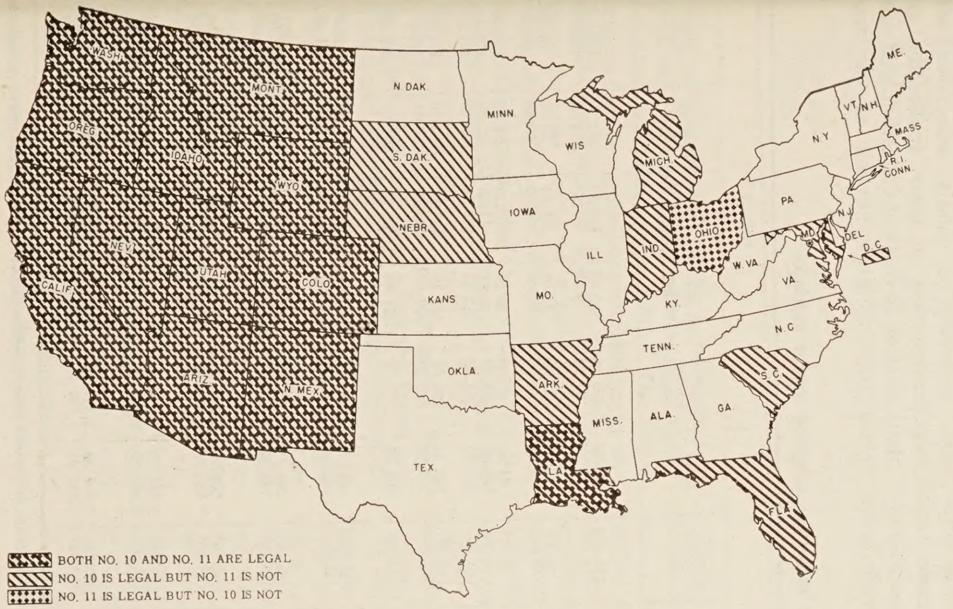


Figure 5.—Legality of 64,000-pound tractor-semitrailer (No. 10) and 72,000-pound truck and full trailer (No. 11).

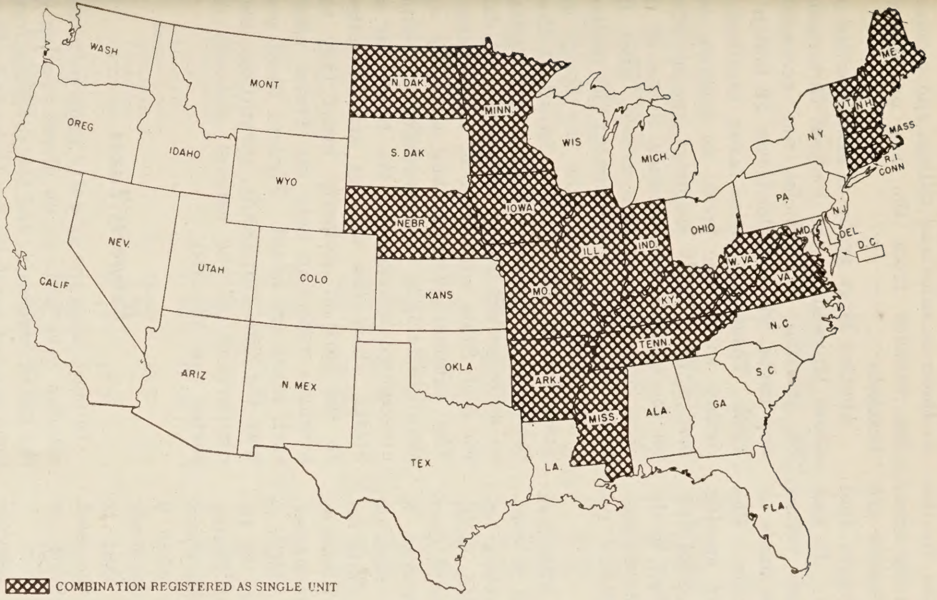


Figure 6.—Registration of tractor-semitrailer as a single unit.

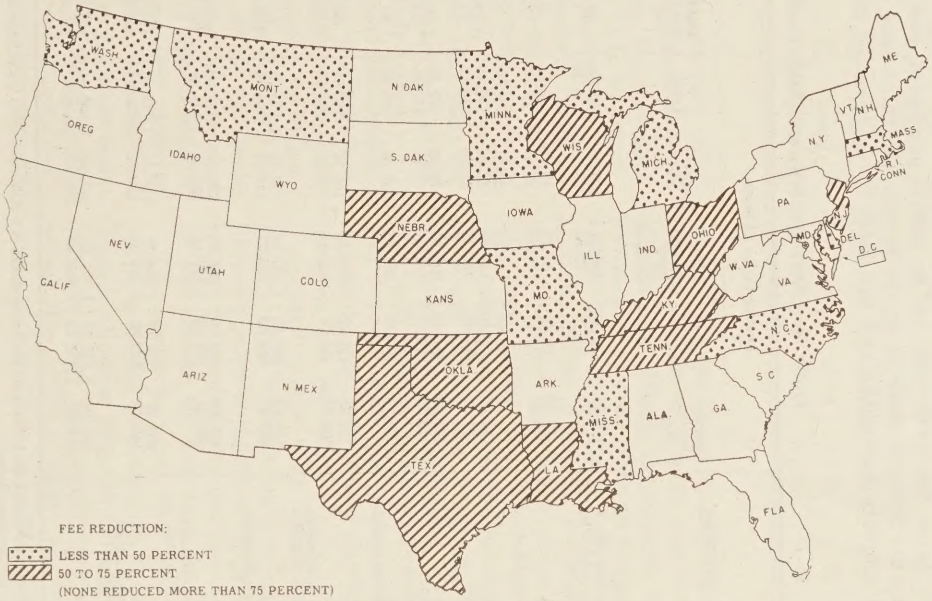


Figure 7.—Reduced registration fees for farm truck (No. 3, pickup truck).

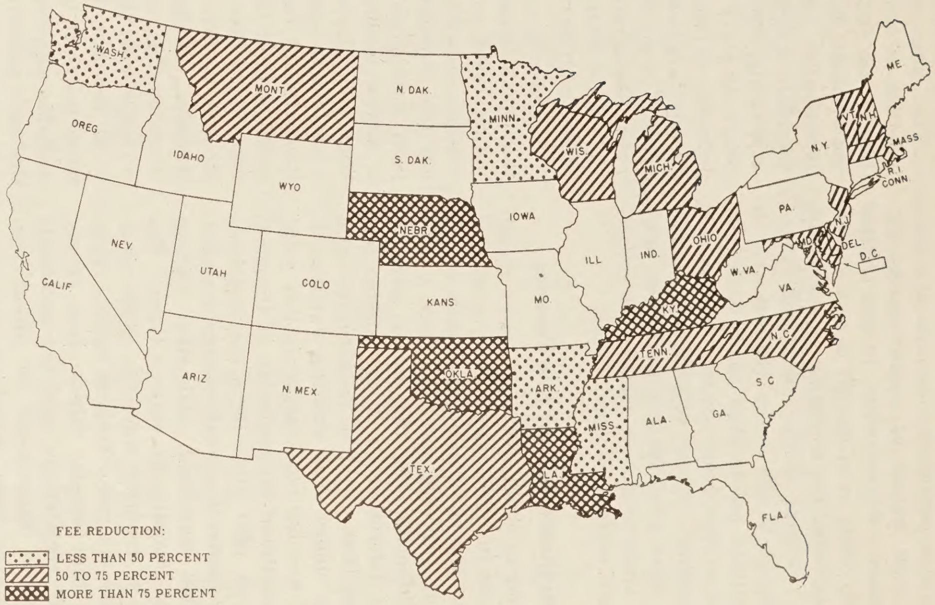


Figure 8.—Reduced registration fees for farm truck (No. 4, stake truck).

but would be permitted to operate at a maximum gross weight of approximately 62,000 pounds. Consequently, it was omitted from the study even though it was eligible to be registered for a slightly smaller gross weight. Several similar situations existed with respect to the heavy vehicles and all were omitted unless they could be legally operated at the gross vehicle weights and sizes specified. Minor adjustments of axle spacing were assumed in a few cases, however, in order to include vehicles that otherwise were within the legal limits.

Specifications and Use Factors

In order to obtain the tax data on a uniform basis in all of the States, a detailed outline of the specifications of each of the 11 vehicles selected was submitted to the State authorities in the latter part of 1952 for determination of the specific fees and taxes that would be payable during a full year under laws existing January 1, 1953 (it was the uncertainty on this point that necessitated the exclusion of Oregon). Table 2 (p. 129) gives these specifications, with the assumed annual mileage traveled, motor fuel consumed, and other factors needed to compute the various taxes. The taxes to be reported were the State road-user taxes—on motor fuel, on vehicle registration, other annual vehicle fees closely related to registration, and the applicable motor-carrier taxes—and all direct personal-property taxes levied on motor vehicles at all levels of government. The property taxes for 1953 were to be estimated by the State authorities on the basis of 1952 property valuations and tax rates.

The same care that was taken in the selection of vehicles was taken in the selection of use factors. "Average" values are not available, however, for the mileages, fuel consumption rates, and earnings. It was therefore necessary to assign these values arbitrarily, but sincere effort was made to select amounts that are reasonable. The primary objective was to supply specific factors to which rates could be applied uniformly in all States, and ones that would reflect these rates in a way that makes possible valid comparisons between States, vehicles, and services.

In order to avoid the complex situations that would have been encountered in computing taxes on vehicles in interstate operation, intrastate use was specified. Without this stipulation, the study would have been impractical. Obviously, however, it is almost unthinkable that large combinations would travel entirely in one State for a whole year—particularly in such States as Rhode Island, Delaware, or for that matter, almost any of the smaller States; and it is improbable that their travel would be restricted to just one of the larger States. However, the stipulation of intrastate travel is permissible, even indispensable, when it is remembered that the purpose of the study is to compare tax rates, rather than to select the most typical vehicles or the most probable amount and kind of service, or the most probable earnings.

It was also specified that the vehicles had been operated in the same State since purchased new in 1951. This made 1953 the third year of registration, thus excluding from the study such nonrecurring taxes as those on sales and titling, and removing the vehicles from the top property-tax brackets.

Another large group of taxes omitted are those imposed by the Federal Government on gasoline, oil, vehicles, and accessories and parts, which yielded over $2 billion in 1952. These are excise taxes, identical in nature with those levied on tobacco, cosmetics, etc. Their exclusion has no effect on the comparisons between States of the data presented in this article, since the levies are uniform throughout the nation.

The data received from the States are presented in tables 4–12. In all of these tables the States are arranged in groupings so as to permit ready comparison of data for each State with those of its neighbors. The national averages and extremes are shown in table 3. The averages are simple unweighted averages of the totals for all States where the vehicles are permitted. In the case of property taxes they are averages reflecting only the States where such taxes are levied. Figures 10–21 portray the data graphically, permitting quick comparisons of the several elements reported (pp. 143-153).

Property Taxes

In most cases the property taxes on motor vehicles have little or no direct relation to the use of highways, and the revenues from them are not available for highways. They are, however, so closely associated with registration fees in their application and their relation to costs of operation, and comprise such a large portion of the total

Table 3.—Average, low, and high road-user and property taxes on selected motor vehicles

Vehicle and service	Average fee for all States [1]					Lowest fee					Highest fee				
	Registration fee, etc.	Motor-fuel tax	Total road-user taxes	Property tax	Total	Registration fee, etc.	Motor-fuel tax [1]	Total road-user taxes	Property tax [1]	Total	Registration fee, etc.	Motor-fuel tax	Total road-user taxes	Property tax	Total
Passenger car:															
Light-weight (No. 1)	$11.95	$30.36	$42.31	$28.41	$58.88	$3.00	$17.28	$28.28	($5.00)	$28.28	$29.26	$40.32	$66.70	$54.32	$88.12
Medium-weight (No. 2)	14.67	38.16	52.83	38.45	75.26	3.00	21.72	32.72	(8.00)	38.96	37.26	50.68	84.82	74.51	115.71
Pickup (No. 3):															
Farm	13.79	20.40	34.19	16.25	43.67	2.50	11.61	20.48	(5.00)	20.48	32.00	27.09	51.34	34.58	64.35
Private	16.97	31.63	48.60	23.86	62.52	2.50	18.00	32.00	(5.00)	44.00	34.80	42.00	68.00	55.06	94.31
Stake truck (No. 4):															
Farm	32.80	28.99	61.79	22.31	74.80	4.00	16.50	31.50	(5.17)	44.50	86.00	38.50	113.50	51.05	127.57
Private	51.07	70.26	121.33	32.96	140.55	10.00	39.99	81.65	(15.00)	100.99	132.50	93.31	199.15	77.50	199.15
Contract	94.16	117.12	211.28	32.96	230.51	25.00	66.66	127.66	(15.00)	127.66	289.00	155.54	401.54	77.50	401.54
Van (No. 5):															
Private	104.65	121.60	226.25	75.92	270.53	26.00	69.21	142.53	(18.25)	160.21	285.00	161.49	400.35	156.16	434.88
Contract	170.12	202.72	372.84	75.92	417.13	59.00	115.38	206.38	(18.25)	206.38	497.50	269.22	766.72	156.16	766.72
Dump (No. 6):															
Private	295.20	390.49	685.69	182.66	792.90	50.00	225.00	427.00	(40.18)	466.00	877.50	525.00	1,252.50	471.95	1,252.50
Three-axle combination (No. 7):															
Private	255.83	421.67	677.50	164.37	773.38	46.00	240.00	442.00	(45.00)	442.00	640.00	560.00	1,040.00	371.32	1,122.37
Contract	399.27	421.67	820.94	164.37	916.82	115.00	240.00	442.00	(45.00)	442.00	915.00	560.00	1,275.00	371.32	1,284.45
Four-axle combination, gasoline (No. 8):															
Private	342.84	845.00	1,187.84	197.79	1,306.52	66.00	487.50	749.50	(45.00)	749.50	961.50	1,137.50	1,637.50	378.13	1,767.00
Contract	588.37	845.00	1,433.37	197.79	1,552.04	130.00	487.50	749.50	(45.00)	749.50	1,824.00	1,137.50	2,555.25	378.13	2,589.54
Four-axle combination, diesel (No. 9):															
Private	415.85	579.05	956.30	259.51	1,112.04	66.00	(324.99)	543.32	(45.00)	586.99	1,524.90	866.64	1,617.98	603.82	1,617.98
Contract	657.53	579.05	1,197.98	259.51	1,353.68	135.00	(324.99)	586.99	(45.00)	586.99	1,816.67	866.64	2,304.16	603.82	2,304.16
Five-axle combination, diesel (No. 10):															
Private	605.69	955.07	1,465.25	413.21	1,713.18	101.00	(680.84)	860.84	(45.00)	1,031.05	2,926.40	1,191.47	2,926.40	777.33	2,926.40
Contract	1,148.47	955.07	2,008.03	413.21	2,255.96	135.00	(680.84)	986.05	(45.00)	1,031.05	2,926.40	1,191.47	3,581.29	777.33	3,581.29
Six-axle combination, diesel (No. 11):															
Private	736.19	1,132.12	1,773.97	453.64	2,000.79	108.50	(837.20)	1,057.20	(310.79)	1,367.99	3,427.20	1,465.10	3,427.20	741.23	3,427.20
Contract	1,844.07	1,132.12	2,881.85	453.64	3,108.67	445.00	(837.20)	1,491.50	(310.79)	1,560.95	3,427.20	1,465.10	4,320.18	741.23	4,475.09

[1] In 20 States, personal-property taxes are not imposed, and in 3 States diesel fuel is not taxed directly. The average fees given are for the States where the respective taxes are collected. The fees in parentheses are the lowest for the same States.

Table 4.—Road-user and personal-property taxes on selected passenger vehicles (Nos. 1 and 2)

State	Light-weight passenger car (No. 1)							Medium-weight passenger car (No. 2)						
						Rank of State							Rank of State	
	Registration fee	Property tax	Other taxes and fees	Gasoline tax	Total	Total fees and taxes	Total, excluding property tax	Registration fee	Property tax	Other taxes and fees	Gasoline tax	Total	Total fees and taxes	Total, excluding property tax
New England:														
Maine	$14.00	$19.69	....	$34.56	$68.25	14	14	$16.00	$26.85	....	$43.44	$86.29	15	15
New Hampshire	14.00	14.18	....	28.80	56.98	24	22	21.15	19.33	....	36.20	76.68	22	17
Vermont	26.00	....	....	28.80	54.80	28	4	26.00	....	....	36.20	62.20	35	12
Massachusetts	4.50	31.50	....	28.80	64.80	18	42	6.50	42.96	....	36.20	85.66	16	38
Rhode Island	12.00	45.28	....	23.04	80.32	6	35	16.00	54.68	....	28.96	99.64	8	34
Connecticut	7.00	38.61	....	23.04	68.65	13	46	9.00	52.55	....	28.96	90.51	12	46
Middle Atlantic:														
New York	15.50	....	....	23.04	38.54	44	30	19.75	....	....	28.96	48.71	41	26
New Jersey	10.00	....	$1.00	17.28	28.28	48	48	16.50	....	$1.00	21.72	39.22	47	44
Pennsylvania	10.00	....	....	28.80	38.80	43	29	10.00	....	....	36.20	46.20	43	32
Delaware	8.00	....	....	28.80	36.80	45	33	8.00	....	....	36.20	44.20	46	36
Maryland	10.00	5.00	....	28.80	43.80	39	28	15.00	8.00	....	36.20	59.20	38	24
District of Columbia	5.00	22.00	....	28.80	55.80	26	41	8.00	32.00	....	36.20	76.20	23	37
West Virginia	17.60	39.78	....	28.80	86.18	2	16	21.80	53.70	....	36.20	111.70	2	16
Southeastern:														
Virginia	10.00	26.18	....	34.56	70.74	12	20	10.00	34.32	....	43.44	87.76	14	22
North Carolina	10.00	27.93	....	40.32	78.25	8	11	12.00	37.48	....	50.68	100.16	7	11
South Carolina	5.00	36.00	....	40.32	81.32	4	18	6.00	48.00	....	50.68	104.68	4	18
Georgia	3.50	29.28	....	34.56	67.34	15	32	4.50	40.72	....	43.44	88.66	13	28
Florida	15.00	....	.25	40.32	55.57	27	3	20.00	....	.25	50.68	70.93	27	4
Kentucky	4.50	33.25	.50	40.32	78.57	7	17	4.50	45.34	.50	50.68	101.02	6	19
Tennessee	7.50	....	.50	40.32	48.32	37	15	10.00	....	.50	50.68	61.18	37	14
Alabama	3.00	18.09	.75	34.56	56.40	25	31	3.00	26.80	.75	43.44	73.99	25	30
Mississippi	10.37	35.10	....	40.32	85.79	3	9	12.62	48.06	....	50.68	111.36	3	10
East Central:														
Ohio	10.00	....	....	23.04	33.04	47	43	10.00	....	....	28.96	38.96	48	45
Indiana	11.00	46.78	.25	23.04	81.07	5	37	12.00	62.01	.25	28.96	103.22	5	39
Illinois	10.50	18.68	....	28.80	57.98	23	25	10.50	23.28	....	36.20	69.98	29	31
Michigan	10.85	....	....	25.92	36.77	46	34	13.30	....	....	32.58	45.88	44	33
Wisconsin	16.00	....	....	23.04	39.04	42	27	16.00	....	....	28.96	44.96	45	35
Minnesota	24.80	....	....	28.80	53.60	30	6	33.30	....	....	36.20	69.50	30	5
Iowa	27.00	....	....	23.04	50.04	35	12	35.00	....	....	28.96	63.96	34	9
Missouri	11.00	17.04	....	17.28	45.32	38	47	11.00	22.05	....	21.72	54.77	39	48
Southwestern:														
Arkansas	13.00	15.19	....	37.44	65.63	17	10	17.00	21.56	....	47.06	85.62	17	8
Louisiana	3.00	....	....	40.32	43.32	40	21	3.00	....	....	50.68	53.68	40	20
Oklahoma	28.76	....	.50	37.44	66.70	16	1	37.26	....	.50	47.06	84.82	18	1
Texas	11.52	17.47	....	23.04	52.03	34	36	18.72	22.33	....	28.96	70.01	28	29
West Central:														
North Dakota	25.00	....	....	28.80	53.80	29	5	35.00	....	....	36.20	71.20	26	3
South Dakota	20.00	....	....	28.80	48.80	36	13	25.00	....	....	36.20	61.20	36	13
Nebraska	5.00	54.32	....	28.80	88.12	1	38	5.00	74.51	....	36.20	115.71	1	40
Kansas	10.35	38.00	....	28.80	77.15	9	26	12.80	50.00	....	36.20	99.00	9	25
Mountain:														
Montana	10.00	28.70	....	34.56	73.26	11	19	10.00	39.30	....	43.44	92.74	11	21
Idaho	5.00	....	....	34.56	39.56	41	24	5.00	....	....	43.44	48.44	42	27
Wyoming	5.00	18.90	....	28.80	52.70	33	40	5.00	25.78	....	36.20	66.98	32	42
Colorado	5.75	18.90	1.00	34.56	60.21	22	23	6.80	25.78	1.00	43.44	77.02	21	23
New Mexico	19.00	....	....	34.56	53.56	31	7	26.00	....	....	43.44	69.44	31	6
Arizona	3.50	28.40	....	28.80	60.70	20	44	3.50	38.80	....	36.20	78.50	20	43
Utah	5.00	28.52	....	28.80	62.32	19	39	5.00	40.30	....	36.20	81.50	19	41
Nevada	5.00	42.79	....	25.92	73.71	10	45	5.00	60.10	....	32.58	97.68	10	47
Pacific:														
Washington	5.00	....	18.25	37.44	60.69	21	2	5.00	....	24.00	47.06	76.06	24	2
Oregon	....	....	....	....	....	....	....	....	....	....	....	....	....	....
California	6.00	....	21.00	25.92	52.92	32	8	6.00	....	27.00	32.58	65.58	33	7

taxes paid on motor vehicles in some States, that their inclusion was necessary in order to obtain equitable comparisons. The registration fees for individual vehicles vary considerably among the States, and property taxes in some instances greatly exceed the registration fees paid. When property taxes and registration fees are considered together, however, the differences among the States are smaller in most instances.

In figure 4 (p. 130) are shown the States in which State or local property taxes are levied and the States in which registration fees are in lieu of ad valorem or property taxes. In this connection it should be noted that the registration fees of quite a few States are based at least in part on the age or valuation of the vehicle. Louisiana permits local property taxes to be levied in addition to the registration fee, but the application of such levies is not general in the State. The relation of property taxes to registration fees and total taxes on motor vehicles is shown in tables 4–12.

It is worth noting that the valuation of motor vehicles for tax purposes is generally conceded to be much closer to market value than is the valuation of other personal property (household furnishings, for instance) subject to the same taxes. It is also probable that motor vehicles constitute a very considerable portion of taxable personal property in many jurisdictions. Therefore, although this study is not directly concerned with personal-property taxes per se, it suggests an area of research that must not be neglected by those interested in the tax burdens on the motor-vehicle owner.

It will be seen in table 4 that the registration fee in Pennsylvania for the light two-door passenger car is $10.00, more than twice as much as the $4.50 shown for Massachusetts. In Pennsylvania, however, the flat registration fee of $10.00, which applies to all automobiles, is in lieu of all other ad valorem taxes, whereas in Massachusetts vehicles are subject to property taxes in addition to registration fees. The addition of the $31.50 property tax to the $4.50 registration fee yields a total of $36.00, which is 3.6 times as much as the Pennsylvania registration fee and much greater than the registration fee alone for any State. North Dakota and Vermont, with registration fees of $25.00 and $26.00, respectively, appear to be exacting greater taxes on the light automobile than other States. Yet in neither of these States is there a property tax on motor vehicles, and when property taxes and registration fees are combined, the total in a great many States exceeds the fees in North Dakota and Vermont. Although Pennsylvania, Massachusetts, North Dakota, and Vermont are used as examples, it may be seen from the tables presented in this study that many other significant comparisons can be made.

Another factor that demonstrates the close relation between registration fees and property taxes is the reduction of the registration fee according to the age (and value) of the vehicle, as may be seen in table 1.

The property taxes that are given in tables 4–12, for all except the farm vehicles, include all taxes levied by the State, county, city, or other local governmental unit in which the vehicle is domiciled, and are the taxes that would be imposed on the vehicles

Table 5.—Road-user and personal-property taxes on a pickup truck, 4,700 pounds gross vehicle weight (No. 3)

State	Farm service							Private operation						
	Registration fee	Property tax	Other taxes and fees	Gasoline tax	Total	Rank of State		Registration fee	Property tax	Other taxes and fees	Gasoline tax	Total	Rank of State	
						Total fees and taxes	Total, excluding property tax						Total fees and taxes	Total, excluding property tax
New England:														
Maine	$15.00	$15.63	....	$23.22	$53.85	9	14	$15.00	$15.63	....	$36.00	$66.63	18	19
New Hampshire	21.15	11.25	....	19.35	51.75	11	5	21.15	11.25	....	30.00	62.40	23	17
Vermont	26.00	....	....	19.35	45.35	20	4	26.00	....	....	30.00	56.00	32	9
Massachusetts	12.00	25.00	....	19.35	56.35	6	33	15.00	25.00	....	30.00	70.00	11	33
Rhode Island	16.50	24.00	....	15.48	55.98	8	30	16.50	34.69	....	24.00	75.19	8	39
Connecticut	14.10	32.18	....	15.48	61.76	3	37	14.10	32.18	....	24.00	70.28	10	42
Middle Atlantic:														
New York	23.50	....	....	15.48	38.98	33	12	23.50	....	....	24.00	47.50	43	29
New Jersey	15.00	....	$1.00	11.61	27.61	47	39	30.00	....	$1.00	18.00	49.00	41	25
Pennsylvania	16.50	....	....	19.35	35.85	36	18	16.50	....	....	30.00	46.50	45	30
Delaware	10.00	....	....	19.35	29.35	46	38	15.00	....	....	30.00	45.00	47	32
Maryland	12.00	5.00	....	19.35	36.35	35	32	12.00	5.00	....	30.00	47.00	44	38
District of Columbia	20.00	17.00	....	19.35	56.35	7	11	20.00	17.00	....	30.00	67.00	17	23
West Virginia	20.00	25.00	....	19.35	64.35	1	10	20.00	31.25	....	30.00	81.25	5	22
Southeastern:														
Virginia	12.00	9.60	....	23.22	44.82	22	22	12.00	20.02	....	36.00	68.02	13	28
North Carolina	10.00	8.74	....	27.09	45.83	18	17	18.80	19.48	....	42.00	80.28	7	4
South Carolina	6.00	11.00	....	27.09	44.09	23	28	6.00	27.00	....	42.00	75.00	9	27
Georgia	2.50	13.28	....	23.22	39.00	32	43	2.50	29.28	....	36.00	67.78	15	41
Florida	24.00	....	.25	27.09	51.34	12	1	24.00	....	.25	42.00	66.25	20	2
Kentucky	4.50	16.00	.50	27.09	48.09	17	29	10.00	32.24	.50	42.00	84.74	3	12
Tennessee	7.50	....	.50	27.09	35.09	40	23	15.00	....	.50	42.00	57.50	31	8
Alabama	15.00	11.34	.50	23.22	50.06	13	13	15.00	18.09	.50	36.00	69.59	12	16
Mississippi	7.00	9.51	....	27.09	43.60	24	25	10.00	29.01	....	42.00	81.01	6	14
East Central:														
Ohio	16.40	....	....	15.48	31.88	43	31	34.80	....	....	24.00	58.80	29	7
Indiana	15.00	31.95	.25	15.48	62.68	2	34	15.00	55.06	.25	24.00	94.31	1	40
Illinois	20.00	10.50	....	19.35	49.85	14	8	20.00	11.25	....	30.00	61.25	25	21
Michigan	16.00	....	....	17.42	33.42	42	27	25.60	....	....	27.00	52.60	36	11
Wisconsin	5.00	....	....	15.48	20.48	48	48	20.00	....	....	24.00	44.00	48	35
Minnesota	20.40	....	....	19.35	39.75	29	7	25.00	....	....	30.00	55.00	35	10
Iowa	25.00	....	....	15.48	40.48	28	6	25.00	....	....	24.00	49.00	40	24
Missouri	15.00	8.29	....	11.61	34.90	41	42	20.00	17.04	....	18.00	55.04	34	43
Southwestern:														
Arkansas	12.00	8.25	....	25.16	45.41	19	16	12.00	12.25	....	39.00	63.25	21	18
Louisiana	3.00	....	....	27.09	30.09	44	36	10.00	....	....	42.00	52.00	37	13
Oklahoma	9.60	....	.50	25.16	35.26	38	20	20.00	....	.50	39.00	59.50	27	5
Texas	9.40	5.17	....	15.48	30.05	45	44	18.80	12.90	....	24.00	55.70	33	37
West Central:														
North Dakota	20.00	....	....	19.35	39.35	30	9	20.00	....	12.00	30.00	62.00	24	3
South Dakota	16.25	....	....	19.35	35.60	37	19	16.25	....	....	30.00	46.25	46	31
Nebraska	4.00	19.82	....	19.35	43.17	25	46	8.00	44.76	....	30.00	82.76	4	44
Kansas	7.50	16.00	....	19.35	42.85	26	40	7.50	25.00	....	30.00	62.50	22	45
Mountain:														
Montana	11.20	19.34	....	23.22	53.76	10	24	16.00	33.25	....	36.00	85.25	2	15
Idaho	12.00	....	....	23.22	35.22	39	21	12.00	....	....	36.00	48.00	42	26
Wyoming	5.00	15.00	....	19.35	39.35	31	45	5.00	15.00	....	30.00	50.00	39	47
Colorado	6.05	15.00	1.00	23.22	45.27	21	35	6.05	15.00	1.00	36.00	58.05	30	36
New Mexico	15.00	....	....	23.22	38.22	34	15	15.00	....	....	36.00	51.00	38	20
Arizona	14.70	22.60	....	19.35	56.65	5	26	14.70	22.60	....	30.00	67.30	16	34
Utah	7.50	14.02	....	19.35	40.87	27	41	7.50	22.32	....	30.00	59.82	26	46
Nevada	5.00	34.58	....	17.42	57.00	4	47	5.00	34.58	....	27.00	66.58	19	48
Pacific:														
Washington	9.75	....	14.50	25.16	49.41	16	3	14.50	....	14.50	39.00	68.00	14	1
Oregon	....	....	....	....	....	....	....	....	....	....	....	....	....	....
California	16.00	....	16.00	17.42	49.42	15	2	16.00	....	16.00	27.00	59.00	28	6

in the capital city of the State. The property taxes given for farm vehicles include State, county, and district or other property taxes that would be collected in an average rural agricultural community in the State. In a few States where uniform State-wide valuation and tax rates are in effect in all jurisdictions, there is no difference between property taxes on farm vehicles and those registered in the capital city of the State.

In two States—California and Washington—property taxes on motor vehicles have been replaced by "in lieu" taxes. These taxes have many characteristics of property taxes, but since neither the levies nor the distribution of their proceeds are directly related to the jurisdiction in which they were collected, they have been classified as road-user imposts. In both of these instances the State courts have ruled them not to be property taxes.

Types of Service

Distinctly different tax rates are in effect in most States for commercial vehicles operated privately (not for hire), as contract carriers (for hire), and in farm service. Information was therefore obtained, and was tabulated separately, for all vehicles in private operation, for the pickup and stake trucks (Nos. 3 and 4) in farm service, and for the stake and van trucks (Nos. 4 and 5) and all combinations (Nos. 7–11) in contract carrier service.

Vehicles in private operation are those used solely for carrying goods owned or sold by the vehicle owner, with no direct transportation charge.

Contract carriers are those employed in hauling goods for others, with a direct transportation charge, at times and to destinations required by the jobs for which they are hired. Operation of contract carriers is usually subject to State franchise and regulation. Common carriers, which operate for hire over established routes and on fixed schedules, are not included in the study because of their more complex tax schedules and forms of regulation, and the fact that their operation is predominantly interstate.

The farm service classification represents a reduced registration fee for farmers' trucks, but without restriction as to the highways they may use. This provision, in various forms, is in effect in 22 States. (The nominal charge imposed as the sole registration fee by some States for farm vehicles licensed for restricted operation on or in the immediate vicinity of the farm is not included in this study.)

Farm Service

Provision for registration of farm trucks at half the regular fee for private trucks is common but, as shown in tables 5 and 6, some States do not allow reductions that great, and some allow considerably more. The reductions for farm vehicles vary not only among the States but also vary somewhat for vehicles of different capacities, as may be seen from a comparison of figures 7 and 8 (p. 131). Large numbers of farm trucks are in the lighter groups, and what may at first glance appear to be relatively minor concessions in registration fees can, in fact, be of major importance from a

Table 6.—Road-user and personal-property taxes on a stake truck, 12,500 pounds gross vehicle weight (No. 4)

State	Farm service							Private operation							Contract carrier							
	Registration fee	Property tax	Other taxes and fees	Gasoline tax	Total	Rank of State		Registration fee	Property tax	Other taxes and fees	Gasoline tax	Total	Rank of State		Registration fee	Property tax	Other taxes and fees	Carrier taxes and fees	Gasoline tax	Total	Rank of State	
						Total fees and taxes	Total, excl. prop. tax						Total fees and taxes	Total, excl. prop. tax							Total fees and taxes	Total, excl. prop. tax
New England:																						
Maine	$60.00	$22.30		$33.00	$115.30	3	3	$60.00	$22.30		$79.98	$162.28	12	11	$60.00	$22.30		$5.00	$133.32	$220.62	20	23
New Hampshire	25.00	16.06		27.50	68.56	29	31	75.00	16.06		66.65	157.71	14	10	75.00	16.06		2.00	111.10	204.16	31	26
Vermont	32.00			27.50	59.50	38	24	118.75			66.65	185.40	4	2	118.75				111.10	229.85	19	15
Massachusetts	12.00	35.68		27.50	75.18	21	46	39.00	35.68		66.65	141.33	20	31	39.00	35.68		5.00	111.10	190.78	33	39
Rhode Island	39.00	28.00		22.00	89.00	11	19	39.00	41.16		53.32	133.48	25	41	39.00	41.16		5.00	88.88	174.04	38	46
Connecticut	37.50	44.33		22.00	103.83	4	22	37.50	44.33		53.32	135.15	22	43	37.50	44.33		5.00	88.88	175.71	37	47
Middle Atlantic:																						
New York	62.50			22.00	84.50	14	6	62.50			53.32	115.82	42	26	62.50				88.88	151.38	47	40
New Jersey	30.00		$1.00	16.50	47.50	47	41	60.00		$1.00	39.99	100.99	48	37	60.00		$1.00		66.66	127.66	48	48
Pennsylvania	45.00			27.50	72.50	25	11	45.00			66.65	111.65	45	29	45.00			64.00	111.10	220.10	21	17
Delaware	22.50			27.50	50.00	44	37	45.00			66.65	111.65	44	28	45.00				111.10	156.10	46	38
Maryland	10.00	7.00		27.50	44.50	48	47	35.00	15.00		66.65	116.65	40	35	35.00	15.00			111.10	161.10	44	41
District of Columbia	35.00	25.50		27.50	88.00	12	18	35.00	25.50		66.65	127.15	28	36	35.00	25.50			111.10	171.60	40	42
West Virginia	38.00	35.68		27.50	101.18	6	15	38.00	44.60		66.65	149.25	18	32	38.00	44.60		14.50	111.10	208.20	30	37
Southeastern:																						
Virginia	19.50	10.80		33.00	63.30	34	33	19.50	25.30		79.98	124.78	30	38	19.50	25.30		160.00	133.32	338.12	5	5
North Carolina	31.25	12.26		38.50	82.01	16	13	62.50	27.32		93.31	183.13	5	6	125.00	27.32			155.54	307.86	6	8
South Carolina	66.00	14.00		38.50	118.50	2	2	66.00	38.00		93.31	197.31	3	5	66.00	38.00		100.00	155.54	359.54	4	4
Georgia	10.00	14.53		33.00	57.53	40	44	10.00	32.03		79.98	122.01	34	45	25.00	32.03		25.00	133.32	215.35	23	29
Florida	53.00		.25	38.50	91.75	9	5	53.00		.25	93.31	146.56	19	9	145.25		.25	100.50	155.54	401.54	1	1
Kentucky	4.50	20.00	.50	38.50	63.50	33	43	32.00	40.30	.50	93.31	166.11	8	18	32.00	40.30	.50	77.00	155.54	305.34	7	9
Tennessee	12.50		.50	38.50	51.50	42	35	25.00		.50	93.31	118.81	39	24	50.00		.50	12.50	155.54	218.54	22	18
Alabama	22.50	14.70	.50	33.00	70.70	28	29	22.50	23.45	.50	79.98	126.43	29	33	22.50	23.45	.50	101.00	133.32	280.77	10	10
Mississippi	21.40	11.10		38.50	71.00	27	21	37.00	34.35		93.31	164.66	10	15	73.00	34.35		7.00	155.54	269.89	12	13
East Central:																						
Ohio	33.70			22.00	55.70	41	30	81.60			53.32	134.92	23	13	81.60			20.00	88.88	190.48	34	25
Indiana	35.00	45.00	.25	22.00	102.25	5	28	35.00	77.50	.25	53.32	166.07	9	46	35.00	77.50	.25	12.00	88.88	213.63	25	44
Illinois	86.00	14.07		27.50	127.57	1	1	86.00	15.08		66.65	167.73	7	8	86.00	15.08			111.10	212.18	26	24
Michigan	26.50			24.75	51.25	43	36	53.00			59.99	112.99	43	27	53.00			30.00	99.99	182.99	35	30
Wisconsin	27.50			22.00	49.50	45	38	110.00			53.32	163.32	11	4	110.00			106.00	88.88	304.88	8	6
Minnesota	32.40			27.50	59.90	36	20	50.00			66.65	116.65	41	25	50.00			7.50	111.10	168.60	42	35
Iowa	70.00			22.00	92.00	8	4	70.00			53.32	123.32	33	20	70.00			5.00	88.88	163.88	43	36
Missouri	50.00	8.29		16.50	74.79	22	14	50.00	17.04		39.99	107.03	46	44	50.00	17.04		25.00	66.66	158.70	45	43
Southwestern:																						
Arkansas	36.00	15.73		35.75	87.48	13	12	42.00	21.83		86.65	150.48	17	16	42.00	21.83			144.43	208.26	28	28
Louisiana	10.00			38.50	48.50	46	40	60.00			93.31	153.31	15	7	120.00			10.00	155.54	285.54	9	7
Oklahoma	22.40		.50	35.75	58.65	39	25	95.00		.50	86.65	182.15	6	3	95.00		.50		144.43	239.93	17	12
Texas	40.62	5.17		22.00	67.79	30	17	81.25	16.21		53.32	150.78	16	14	81.25	16.21		11.00	88.88	197.34	32	31
West Central:																						
North Dakota	32.00			27.50	59.50	37	23	32.00		21.00	66.65	119.65	37	22	32.00		21.00	50.00	111.10	214.10	24	19
South Dakota	37.50			27.50	65.00	31	16	37.50		95.00	66.65	199.15	1	1	37.50		95.00	10.00	111.10	253.60	14	11
Nebraska	4.00	31.42		27.50	62.92	35	48	60.00	70.96		66.65	197.61	2	17	60.00	70.96		10.00	111.10	252.06	16	32
Kansas	30.00	19.00		27.50	76.50	17	27	30.00	30.00	6.30	66.65	132.95	26	34	30.00	30.00		63.00	111.10	234.10	18	22
Mountain:																						
Montana	13.60	29.00		33.00	75.60	19	42	28.00	49.87		79.98	157.85	13	30	28.00	49.87		50.00	133.32	261.19	13	21
Idaho	40.00			33.00	73.00	23	10	40.00			79.98	119.98	35	21	40.00				133.32	173.32	39	34
Wyoming	15.00	21.41		27.50	63.91	32	45	15.00	21.41		66.65	103.06	47	48	15.00	21.41		60.70	111.10	208.21	29	27
Colorado	17.50	21.41	1.00	33.00	72.91	24	34	17.50	21.41	1.00	79.98	119.89	36	39	17.50	21.41	1.00	80.00	133.32	253.23	15	14
New Mexico	43.50			33.00	76.50	18	8	43.50			79.98	123.48	32	19	21.75			25.00	133.32	180.07	36	33
Arizona	30.00	32.20		27.50	89.70	10	26	30.00	32.20		66.65	128.85	27	40	30.00	32.20		200.00	111.10	373.30	3	3
Utah	25.00	19.00		27.50	71.50	26	32	25.00	32.86		66.65	124.51	31	42	25.00	32.86			111.10	168.96	41	45
Nevada	23.85	51.05		24.75	99.65	7	39	23.85	51.05		59.99	134.89	24	47	23.85	51.05		102.15	99.99	277.04	11	16
Pacific:																						
Washington	17.50		22.00	35.75	75.25	20	9	30.00		22.00	86.65	138.65	21	12	30.00		22.00	15.00	144.43	211.43	27	20
Oregon																						
California	36.00		23.00	24.75	83.75	15	7	36.00		23.00	59.99	118.99	38	23	36.00		23.00	230.00	99.99	388.99	2	2

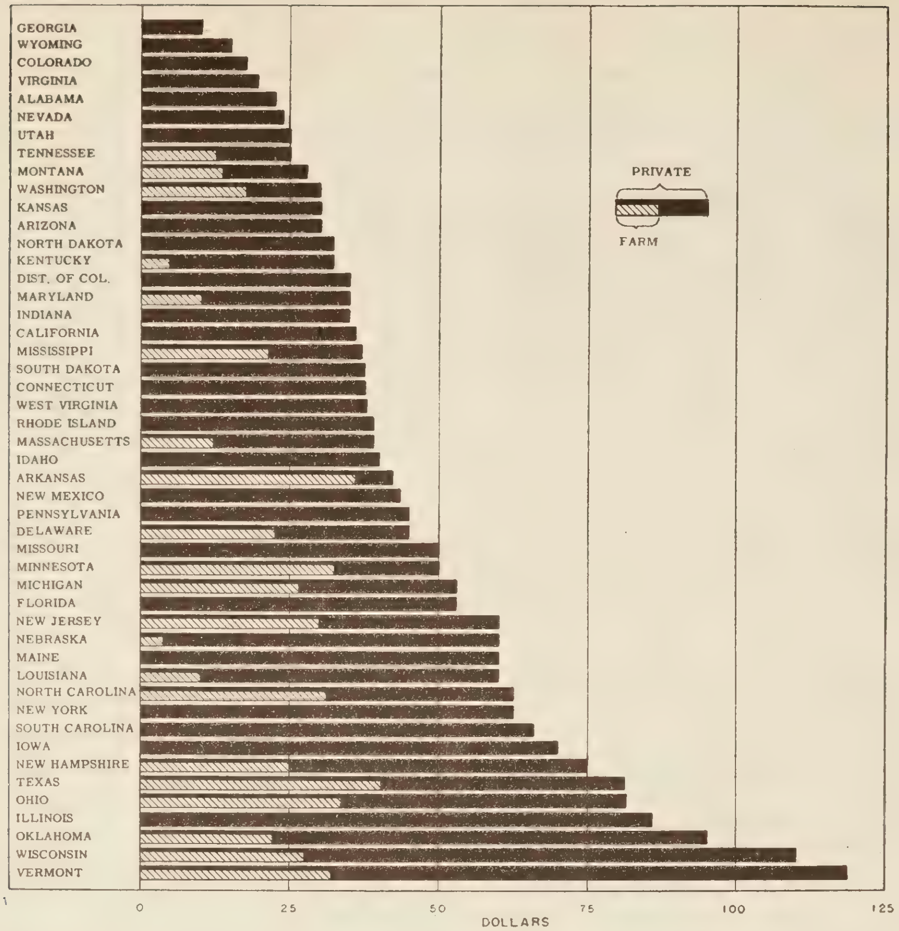


Figure 9.—Comparison of private operation and farm service registration fees on a 12,500-pound stake truck (No. 4).

revenue standpoint, particularly in predominantly agricultural States. In 4 States, as indicated in figure 8, the farm classification allows the 12,500-pound stake truck (No. 4) a reduction of more than 75 percent in registration fee, in 13 States the reduction is from 50 to 75 percent, and in 4 States, it is less than 50 percent. A comparison of the regular and farm registration fees for this vehicle in each State is shown in figure 9.

In Nebraska, the regular registration fee for the 12,500-pound stake truck is $60.00, but a farmer can register the same truck for $4.00. In Kentucky, a flat fee of $4.50 is applicable to farm trucks of 22,000 pounds or less, but a 22,000-pound vehicle in private use requires a registration fee of $134.00. The importance of these figures is underscored by the fact that in 1951 more than 54 percent of Nebraska's trucks, and in Kentucky, over 39 percent, were registered at reduced farm rates. Similar situations exist in other States, but in most the reductions are not as great. In New Hampshire, for example, a farm truck of less than 16,000 pounds may be registered at a flat fee of $25.00, but since this is greater than the regular fee of $21.15 for a pickup truck having a gross weight of 4,700 pounds, the farm rate is of no advantage to owners of the pickup. Consequently, only 5.2 percent of the total truck registrations in New Hampshire are in the farm classification.

In 1951, the farm truck registrations were more than half of all truck registrations in 5 States, and exceeded 30 percent in 13 States. It should not be forgotten, however, that the special reduced rates for registration of farm trucks are in part compensated for by the fact that farm trucks probably average fewer miles per year than other trucks. Thus the reductions are not as great on a cents-per-mile basis as it might appear from the comparisons in tables 5 and 6 and in figures 7 and 8.

Carrier Taxes

In the consideration of motor-carrier service, the gross receipts taxes and other levies that are imposed on general business, and not limited to motor carriers, have been eliminated. Fees for authority to operate, and other fees paid only at the time a carrier begins to haul goods for hire, have also been excluded.

Care should be taken in comparing the carrier taxes of the several States. Many of the States have special registration classes for vehicles used in contract (for-hire) service. The fees in the special registration classes, in most cases, are substantially greater than the registration fees for vehicles in private (not-for-hire) service. The difference, while technically classed as part of the registration fee, is in reality a special carrier fee. There is, of course, the compensating factor that vehicles in carrier service usually can be expected to operate a considerably greater mileage than those in private use, thus reducing the per-mile cost of their registration fees.

The majority of trucks are used for the ordinary private service of carrying goods owned or sold by the vehicle owner, and for which there is no direct transportation charge. Even these trucks, however, are subject to mileage or other carrier taxes under some conditions, and the variations in the tax structures of the States made it necessary in a few instances to make arbitrary decisions on the inclusion or exclusion of these special levies.

The general policy followed was to include only the taxes that have to be paid on almost all of the vehicles in a given group. For example, the laws of some States are so written that practically all vehicles of more than 1½ tons (manufacturer's rated capacity) have to pay certain mileage or compensatory taxes, whether in private or contract operation. In the same States many vehicles of 1½-ton capacity or less are not subject to the tax. In such a case the tax has been shown only for the heavier vehicles. It should be remembered that the purpose of the study is to present a comparison of tax rates and burdens on certain typical vehicles rather than to include all taxes on all vehicles. Undoubtedly many of the larger trucks traveling in interstate commerce are subject to greater taxes than are reported in this study, and are also subject to additional restrictions and regulations. The larger units apparently have certain offsetting economic advantages, however, or they would not be in use.

Mileage Taxes

The classification and treatment of mileage taxes is something of a problem. Historically, road-user taxes have been classed by most authorities into three major groups. The first and most important of these consists of fuel taxes and miscellaneous fees incidental to fuel taxation. The second major group of taxes, usually termed motor-vehicle revenues, consists of motor-vehicle registration fees and a group of additional fees, some of which are not paid annually, that include title fees, drivers' licenses, and other revenues of relatively minor importance. The third group of road-user revenues, motor-carrier taxes, consists of special taxes on for-hire carriers.

These three groups have in the past afforded adequate classification of road-user revenues, although there are borderline instances in which there was considerable question as to proper classification. Most common among these, of course, is the annual registration fee in States that levy higher plate fees on for-hire carriers. Should

Table 7.—Road-user and personal-property taxes on a single-unit van truck, 19,000 pounds gross vehicle weight (No. 5)

State	Private operation							Contract carrier							
	Registration fee	Property tax	Other taxes and fees	Gasoline tax	Total	Rank of State		Registration fee	Property tax	Other taxes and fees	Carrier taxes and fees	Gasoline tax	Total	Rank of State	
						Total fees and taxes	Total, excl. prop. tax							Total fees and taxes	Total, excl. prop. tax
New England:															
Maine	$125.00	$60.74	....	$138.42	$324.16	7	14	$125.00	$60.74	....	$5.00	$230.76	$421.50	21	23
New Hampshire	114.00	43.73	....	115.35	273.08	21	21	114.00	43.73	....	2.00	192.30	352.03	33	33
Vermont	199.50	....	....	115.35	314.85	9	2	199.50	....	....	....	192.30	391.80	26	19
Massachusetts	57.00	97.18	....	115.35	269.53	24	41	57.00	97.18	....	5.00	192.30	351.48	34	43
Rhode Island	54.00	114.00	....	92.28	260.28	29	47	54.00	114.00	....	5.00	153.84	326.84	41	47
Connecticut	57.00	111.17	....	92.28	260.45	28	45	57.00	111.17	....	5.00	153.84	327.01	40	46
Middle Atlantic:															
New York	95.00	....	$90.00	92.28	277.28	18	9	95.00	....	....	150.00	153.84	398.84	23	15
New Jersey	90.00	....	1.00	69.21	160.21	48	44	90.00	....	$1.00	....	115.38	206.38	48	48
Pennsylvania	96.00	....	....	115.35	211.35	42	28	96.00	....	....	92.00	192.30	380.30	28	21
Delaware	71.00	....	....	115.35	186.35	46	36	71.00	....	....	....	192.30	263.30	46	40
Maryland	100.00	35.00	....	115.35	250.35	30	26	100.00	35.00	....	....	192.30	327.30	39	37
District of Columbia	65.00	56.50	....	115.35	236.85	35	40	65.00	56.50	....	....	192.30	313.80	43	42
West Virginia	84.50	121.48	....	115.35	321.33	8	29	84.50	121.48	....	23.50	192.30	421.78	20	35
Southeastern:															
Virginia	45.60	66.00	....	138.42	250.02	31	38	45.60	66.00	....	230.00	230.76	572.36	6	7
North Carolina	152.00	55.00	....	161.49	368.49	5	3	266.00	55.00	....	....	269.22	590.22	4	4
South Carolina	126.00	88.00	....	161.49	375.49	3	6	126.00	88.00	....	100.00	269.22	583.22	5	8
Georgia	50.00	74.58	....	138.42	263.00	26	34	100.00	74.58	....	25.00	230.76	430.34	18	25
Florida	86.00	....	.25	161.49	247.74	33	17	246.75	....	.25	250.50	269.22	766.72	1	1
Kentucky	112.00	97.93	.75	161.49	372.17	4	12	45.00	97.93	.50	121.00	269.22	533.65	7	11
Tennessee	80.00	....	.50	161.49	241.99	34	18	140.00	....	.50	12.50	269.22	422.22	19	12
Alabama	50.00	43.50	.50	138.42	232.42	37	33	50.00	43.50	.50	126.00	230.76	450.76	15	14
Mississippi	94.00	54.19	....	161.49	309.68	10	16	187.00	54.19	....	13.00	269.22	523.41	9	10
East Central:															
Ohio	168.80	....	....	92.28	261.08	27	15	168.80	....	....	20.00	153.84	342.64	37	30
Indiana	50.00	156.16	.25	92.28	298.69	12	48	50.00	156.16	.25	12.00	153.84	372.25	29	45
Illinois	159.00	18.25	....	115.35	292.60	14	11	159.00	18.25	....	....	192.30	369.55	30	27
Michigan	129.00	....	....	103.82	232.82	36	20	129.00	....	....	50.00	173.07	352.07	32	26
Wisconsin	185.00	....	....	92.28	277.28	19	10	185.00	....	....	190.00	153.84	528.84	8	5
Minnesota	80.00	....	....	115.35	195.35	44	31	80.00	....	....	7.50	192.30	279.80	45	39
Iowa	190.00	....	....	92.28	282.28	16	7	190.00	....	....	5.00	153.84	348.84	36	28
Missouri	80.00	30.08	....	69.21	179.29	47	46	80.00	30.08	....	25.00	115.38	250.46	47	44
Southwestern:															
Arkansas	67.00	32.10	....	149.96	249.06	32	24	67.00	32.10	....	....	249.99	349.09	35	31
Louisiana	120.00	....	....	161.49	281.49	17	8	240.00	....	....	10.00	269.22	519.22	10	6
Oklahoma	145.00	....	.50	149.96	295.46	13	5	145.00	....	.50	....	249.99	395.49	24	17
Texas	133.00	42.22	....	92.28	267.50	25	23	133.00	42.22	....	11.00	153.84	340.06	38	36
West Central:															
North Dakota	44.00	....	30.00	115.35	189.35	45	32	44.00	....	30.00	50.00	192.30	316.30	42	32
South Dakota	100.00	....	185.00	115.35	400.35	2	1	100.00	....	185.00	10.00	192.30	487.30	12	9
Nebraska	100.00	134.56	....	115.35	349.91	6	27	100.00	134.56	....	10.00	192.30	436.86	17	34
Kansas	100.00	60.00	23.75	115.35	299.10	11	19	100.00	60.00	....	118.75	192.30	471.05	13	13
Mountain:															
Montana	50.00	99.11	....	138.42	287.53	15	35	50.00	99.11	....	67.50	230.76	447.37	16	29
Idaho	60.00	....	....	138.42	198.42	43	30	60.00	....	....	....	230.76	290.76	44	38
Wyoming	50.00	58.31	....	115.35	223.66	39	42	50.00	58.31	....	115.31	192.30	415.92	22	24
Colorado	25.00	58.31	1.00	138.42	222.73	40	43	25.00	58.31	1.00	142.00	230.76	457.07	14	16
New Mexico	78.00	....	....	138.42	216.42	41	25	39.00	....	....	125.00	230.76	394.76	25	18
Arizona	68.00	87.40	....	115.35	270.75	22	39	68.00	87.40	....	287.50	192.30	635.20	2	3
Utah	70.00	91.14	....	115.35	276.49	20	37	70.00	91.14	....	....	192.30	353.44	31	41
Nevada	38.70	139.06	153.30	103.82	434.88	1	4	38.70	139.06	....	153.30	173.07	504.13	11	22
Pacific:															
Washington	75.00	....	45.25	149.96	270.21	23	13	75.00	....	45.25	18.00	249.99	388.24	27	20
Oregon	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
California	66.00	....	56.00	103.82	225.82	38	22	66.00	....	56.00	325.00	173.07	620.07	3	2

the difference between the registration fee in private operation and for-hire operation be classed as a carrier tax? It has not been in the past, under the theory that carriers' vehicles as a rule can be expected to operate more miles than vehicles in private operation, and that the higher registration fee for carriers' vehicles serves as an adjustment for the greater mileage.

Another instance of borderline classification is the special fee charged to diesel-powered vehicles in the States that do not tax diesel fuel. An argument can be made for classification of these additional registration fees as fuel taxes. But the important point is the fairness of the State's tax system, and this is judged primarily on the total taxes levied on any vehicle, provided, of course, that the methods of reporting or collecting the tax do not in themselves impose additional burdens of record keeping or other requirements not reflected in the actual amounts of taxes paid.

We may be witnessing the development of a field of highway taxation—mileage and ton-mile taxes—that should not be placed in any of the three historical groups. It does not appear that the mileage taxes in Idaho, New York, and Oregon can be classed as fuel taxes, as registration fees, or as carrier taxes. They are avowed attempts to obtain specific amounts of revenues based almost entirely on the vehicles and their use and make no distinction between operation for profit as a transportation facility, and operation incidental to the conduct of any other enterprise. It is not suggested at present that a separate classification of mileage taxes be established, but it is time to put forth the question for discussion. Several States have shown great interest in mileage taxes and, if the movement spreads, those interested in highway finance will be required to give it considerable attention.

Mileage taxes may prove to have two great advantages: They should yield considerable amounts of revenue, and they should, in theory at least, be imposed at rates that measure value of service received, to be applied toward the costs of providing the service. Undoubtedly the mileage tax will also prove to have at least two major offsetting disadvantages. The most important of these from the States' point of view is the cost of administration: The cost of establishing and maintaining complete records, weight stations, and enforcement staff will make any State considering a mileage tax look twice. For the vehicle owner, the maintenance of records for filing of reports necessary under a mileage tax will certainly constitute a substantial burden over and above the actual amount of tax paid.

Administration and Application

While this study is based primarily on legislation, it is necessary to call attention to administration and enforcement as they affect vehicle taxation. The interpretation and application of road-user taxes in one State as compared to another with similar tax laws might easily result in substantial tax differences on similar vehicles in similar service. Rigid insistence that vehicles be registered for the full weights they carry (not to be confused with size and weight

Table 8.—Road-user and personal-property taxes on a single-unit, three-axle dump truck, 40,000 pounds gross vehicle weight (No. 6)

State	Private operation						
						Rank of State	
	Registration fee	Property tax	Other taxes and fees	Gasoline tax	Total	Total fees and taxes	Total, excluding property tax
New England:							
Maine	$300.00	$140.88	....	$450.00	$890.88	11	15
New Hampshire	240.00	101.43	....	375.00	716.43	30	31
Vermont	420.00	....	....	375.00	795.00	18	11
Massachusetts	120.00	225.40	....	375.00	720.40	29	44
Rhode Island	127.00	265.00	....	300.00	692.00	34	46
Connecticut	200.00	257.86	....	300.00	757.86	25	42
Middle Atlantic:							
New York	200.00	....	$187.50	300.00	687.50	35	23
New Jersey	240.00	....	1.00	225.00	466.00	46	45
Pennsylvania	250.00	....	....	375.00	625.00	41	28
Delaware	155.00	....	....	375.00	530.00	45	35
Maryland	200.00	50.00	....	375.00	625.00	40	33
District of Columbia	150.00	132.00	....	375.00	657.00	39	39
West Virginia	242.00	281.75	....	375.00	898.75	10	30
Southeastern:							
Virginia	180.00	150.48	....	450.00	780.48	20	27
North Carolina	320.00	165.67	....	525.00	1,010.67	6	7
South Carolina	351.00	209.00	....	525.00	1,085.00	4	4
Georgia	50.00	206.24	....	450.00	706.24	33	43
Florida	189.00	....	.25	525.00	714.25	32	21
Kentucky	350.00	227.09	.75	525.00	1,102.84	3	5
Tennessee	275.00	....	.50	525.00	800.50	17	10
Alabama	50.00	101.84	.50	450.00	602.34	43	40
Mississippi	....	....	....	....	....	....	....
East Central:							
Ohio	492.25	....	....	300.00	792.25	19	12
Indiana	200.00	471.95	.25	300.00	972.20	8	41
Illinois	640.00	56.25	....	375.00	1,071.25	5	2
Michigan	378.00	....	....	337.50	715.50	31	20
Wisconsin	460.00	....	....	300.00	760.00	24	14
Minnesota	350.00	....	....	375.00	725.00	28	19
Iowa	465.00	....	....	300.00	765.00	22	13
Missouri	300.00	48.12	....	225.00	573.12	44	37
Southwestern:							
Arkansas	200.00	40.18	....	487.50	727.68	26	22
Louisiana	200.00	....	....	525.00	725.00	27	18
Oklahoma	395.00	....	.50	487.50	883.00	12	3
Texas	360.00	103.17	....	300.00	763.17	23	26
West Central:							
North Dakota	400.00	....	100.00	375.00	875.00	13	6
South Dakota	412.50	....	465.00	375.00	1,252.50	1	1
Nebraska	220.00	353.46	....	375.00	948.46	9	32
Kansas	250.00	140.00	100.00	375.00	865.00	14	17
Mountain:							
Montana	300.00	230.84	....	450.00	980.84	7	16
Idaho	....	....	394.20	450.00	844.20	16	8
Wyoming	150.00	135.24	....	375.00	660.24	38	38
Colorado	75.00	135.24	1.00	450.00	661.24	37	36
New Mexico	172.50	....	....	450.00	622.50	42	29
Arizona	188.50	202.80	....	375.00	766.30	21	34
Utah	295.00	177.32	....	375.00	847.32	15	24
Nevada	85.05	322.55	398.00	337.50	1,143.10	2	9
Pacific:							
Washington	....	....	....	....	....	....	....
Oregon	....	....	....	....	....	....	....
California	206.00	....	126.00	337.50	669.50	36	25

limit enforcement), would undoubtedly increase the registration revenues of some States. Practices are understood to vary considerably in this respect. It is necessary, therefore, that any careful comparison of road-user taxes be accompanied by a close examination of practices and interpretations in the application of existing statutes. The data presented in this study make no allowances for such differences.

The payment of motor-fuel taxes is another item that merits close examination. Practically all persons familiar with highway finance agree that some of the gasoline used on the highways escapes taxation (by means of refunded taxes), and that the amounts vary greatly between States. There is no way of knowing how much revenue escapes through excessive refund claims, but it is probable that the total is considerable.

For example, the stipulation in this study for the light-weight automobile is 9,500 miles of annual travel at 16.5 miles per gallon, with total gasoline consumption of 576 gallons for the year. Yet the average for *all* vehicles in one State was less than 500 taxed gallons in both 1950 and 1951. Traffic counts and other information indicate that the residents operate their vehicles about as much as residents of other States. In view of the amazing "fuel economy" of their vehicles, it appears that taxation of ownership, as distinguished from taxation of use, is a surer source of revenue under such conditions. (The State legislature apparently made this deduction some time ago, and imposed registration fees of $25.00 and $35.00 on light and medium-weight passenger cars, respectively, and eliminated reductions for farm trucks.)

Another subject for scrutiny is the collection of diesel-fuel taxes. There are numerous ways of avoiding or evading the tax on diesel fuel, and the State authorities charged with collecting it are in practically unanimous agreement that a considerable amount escapes taxation or is uncollectible. These authorities feel, however, that the situation is improving.

Summary of Comparisons

The foregoing discussion concerns general subjects rather than specific vehicles, except for the remarks on farm rates. It is impractical to include in this report a full discussion of each of the tables and charts presented, but there are comparisons and items of special interest that do merit being called to attention in connection with each of the vehicles.

Vehicle No. 1, light-weight passenger car (table 4; fig. 12).—Registration fees for the light-weight passenger car range from $3.00 to $28.76, total road-user taxes from $28.28 to $66.70. Since this vehicle is assumed to use 576 gallons of gasoline a year, each cent of a State's gasoline tax rate amounts to a levy of $5.76 during the course of a year, or 11 cents a week. The lowest gasoline tax rate costs the owner of the light passenger car 33 cents a week, the highest about 78 cents a week.

There are 15 States with property taxes alone that exceed the total road-user taxes paid in the lowest State. (The property taxes shown on these vehicles are for the State capitals, however, and undoubtedly exceed the averages for the States in most cases.)

There are 25 States in which the total road-user taxes on this light automobile amount to less than $40 a year, or 80 cents a week. In 11 of the States, road-user taxes amount to between $40 and $50, and in 10 States they are between $50 and $60. In only two States do they exceed $60.

Vehicle No. 2, medium-weight passenger car (table 4).—The medium- and light-weight passenger cars are representative of far more than half of all vehicles on the highways. Although the taxation of automobiles probably receives less attention than the taxation of heavier commercial units, automobiles, because of their vast numbers, contribute substantially more in road-user taxes.

There are not great differences between the road-user taxes on light automobiles and those of medium weight. The registration fees for this vehicle range from $3.00 to $37.26. The $37.26 fee applies in Oklahoma and this registration fee combined with a 6.5-cent gasoline tax makes the total road-user taxes $84.82, the highest for this vehicle in any State. However, there is no property tax on motor vehicles in Oklahoma and if property taxes are included for States in which they are imposed, Oklahoma ranks 18th in total fees and taxes. Nebraska, on the other hand, with a $5.00 registration fee and a 5-cent gasoline tax, obtains a total of $41.20 in road-user taxes on the medium-weight sedan, and ranks 40th among the States. If the property tax of $74.51 is added, however, the total becomes $115.71, the highest in any State.

Vehicle No. 3, pickup truck (table 5; fig. 13).—The registration fees for the pickup truck in private use are slightly higher than those on passenger cars in most States. However, large numbers of pickup trucks

Table 9.—Road-user and personal-property taxes on the tractor and the semitrailer of a three-axle combination, 40,000 pounds gross vehicle weight (No. 7), in private operation

State	Tractor-truck					Semitrailer			
	Registration fee	Property tax	Other taxes and fees	Gasoline tax	Total	Registration fee	Property tax	Other taxes and fees	Total
New England:									
Maine	$300.00	$76.28	....	$480.00	$856.28	$5.00	$75.00	....	$80.00
New Hampshire	240.00	94.52	....	400.00	734.52	....	....	....	....
Vermont	420.00	....	....	400.00	820.00	15.00	....	....	15.00
Massachusetts	120.00	122.04	....	400.00	642.04	2.00	88.00	....	90.00
Rhode Island	127.00	144.00	....	320.00	591.00	2.00	103.00	....	105.00
Connecticut	200.00	240.29	....	320.00	760.29	....	....	....	....
Middle Atlantic:									
New York	88.25	....	$370.00	320.00	778.25	90.00	....	....	90.00
New Jersey	110.00	....	1.00	240.00	351.00	90.00	....	$1.00	91.00
Pennsylvania	120.00	....	....	400.00	520.00	75.00	....	....	75.00
Delaware	83.00	....	....	400.00	483.00	67.00	....	....	67.00
Maryland	35.00	30.00	....	400.00	465.00	100.00	15.00	....	115.00
District of Columbia	65.00	75.50	....	400.00	540.50	50.00	70.40	....	120.40
West Virginia	227.00	152.55	....	400.00	779.55	15.00	110.00	....	125.00
Southeastern:									
Virginia	30.00	82.28	....	480.00	592.28	150.00	59.40	....	209.40
North Carolina	160.00	72.28	....	560.00	792.28	160.00	68.60	....	228.60
South Carolina	66.00	100.00	....	560.00	726.00	96.00	77.00	....	173.00
Georgia	20.00	52.16	....	480.00	552.16	100.00	80.52	....	180.52
Florida	88.00	....	.25	560.00	648.25	109.50	....	.25	109.75
Kentucky	350.00	122.96	.75	560.00	1,033.71	....	88.66	....	88.66
Tennessee	275.00	....	.50	560.00	835.50	....	....	....	....
Alabama	50.00	50.25	.50	480.00	580.75	25.00	40.20	.50	65.70
Mississippi	271.00	61.86	....	560.00	892.86	11.00	45.75	....	56.75
East Central:									
Ohio	177.20	....	....	320.00	497.20	135.20	....	....	135.20
Indiana	190.00	204.75	.25	320.00	715.00	25.00	166.57	....	191.57
Illinois	640.00	78.75	....	400.00	1,118.75	....	....	....	....
Michigan	154.00	....	....	360.00	514.00	127.75	....	....	127.75
Wisconsin	60.00	....	....	320.00	380.00	167.50	....	....	167.50
Minnesota	350.00	....	....	400.00	750.00	10.00	....	....	10.00
Iowa	435.00	....	....	320.00	755.00	60.00	....	....	60.00
Missouri	300.00	32.08	....	240.00	572.08	7.00	16.04	....	23.04
Southwestern:									
Arkansas	200.00	34.56	....	520.00	754.56	5.00	29.40	....	34.40
Louisiana	140.00	....	....	560.00	700.00	120.00	....	....	120.00
Oklahoma	65.00	....	.50	520.00	585.50	295.00	....	.50	295.50
Texas	154.00	56.00	....	320.00	530.00	117.00	45.46	....	162.46
West Central:									
North Dakota	400.00	....	100.00	400.00	900.00	....	....	....	....
South Dakota	162.50	....	215.00	400.00	777.50	60.00	....	185.00	245.00
Nebraska	240.00	160.76	....	400.00	800.76	1.00	111.36	....	112.36
Kansas	30.00	83.00	200.00	400.00	713.00	100.00	55.00	....	155.00
Mountain:									
Montana	60.00	124.82	....	480.00	664.82	32.50	90.03	....	122.53
Idaho	65.00	....	....	480.00	545.00	54.00	....	....	54.00
Wyoming	50.00	73.22	....	400.00	523.22	40.00	52.80	....	92.80
Colorado	25.00	73.22	1.00	480.00	579.22	20.00	52.80	....	72.80
New Mexico	88.50	....	....	480.00	568.50	74.00	....	....	74.00
Arizona	69.50	109.80	....	400.00	579.30	50.95	79.20	....	130.15
Utah	70.00	91.76	....	400.00	561.76	90.00	81.84	....	171.84
Nevada	39.60	174.64	156.40	360.00	730.64	32.85	125.93	133.15	291.93
Pacific:									
Washington	105.00	....	46.25	520.00	671.25	55.00	....	39.50	94.50
Oregon	....	....	....	....	....	....	....	....	....
California	66.00	....	71.00	360.00	497.00	81.00	....	52.00	133.00

are registered at reduced farm rates. The lowest registration fee on any vehicle covered in the study, $2.50, applies to pickup trucks in Georgia regardless of whether they are in farm or private service. The highest registration fee on the pickup truck, $34.80, was found in Ohio. It is probable that pickup trucks outnumber other trucks in many States. Consequently, although the total taxes on each pickup are relatively small compared to taxes on heavier vehicles, the large number of pickups makes this an extremely important category from a revenue standpoint.

Vehicle No. 4, stake truck, 12,500 pounds gross vehicle weight (table 6; fig. 14).—Vehicles in the 12,500-pound group are subject to registration fees that in some States break away rather sharply from the fees charged on automobiles and pickup trucks, although this is not true in all cases. The stake truck may be registered in Wyoming for $15.00, in Colorado for $17.50, and in Virginia for $19.50. In Vermont and Wisconsin, however, the fees are $118.75 and $110.00, respectively, for registration in private service. The farm rates, as discussed elsewhere, offer vehicles substantial reductions in many States, including Vermont and Wisconsin.

In contrast to the heavier trucks, there are large numbers of vehicles registered in the approximate weight range represented by this 12,500-pound unit (the group commonly classed as "1½-ton").

Vehicle No. 5, van truck, 19,000 pounds gross vehicle weight (table 7; fig. 15).—The lowest registration fee on the 19,000-pound van truck, $25.00, is found in Colorado, and the highest, $199.50, is found in Vermont. Although this van can be registered in South Dakota for $100.00 (slightly below the average of $104.65 for all States) the inclusion of the mileage tax of $185.00 in South Dakota makes a total of $400.35 in road-user taxes, the highest found in any State on this vehicle.

Vehicle No. 6, 40,000-pound dump truck (table 8; fig. 16).—The 40,000-pound dump truck, with perhaps minor adjustments of axle spacing, would be permitted to operate in all States except Mississippi and Washington. (Its axle spacing and loading are representative of concrete transit-mix and other special equipment.) The lowest registration fees on this vehicle are $50.00 in Alabama and Georgia and $75.00 in Colorado. These are the only States that still register trucks on the basis of manufacturer's rated capacity. The highest fee, $640.00, is found in Illinois, and the average for all States is $295.20. Although the Illinois registration fee is higher than that of any other State on this vehicle, the total road-user taxes on it would be greater in South Dakota, where the mileage tax applies.

Vehicle No. 7, 40,000-pound combination (table 10; fig. 17).—The 40,000-pound combination is typical of the largest group of combinations, and is found in substantial numbers even where much heavier vehicles are permitted. It is legal in all States. The average road-user tax payment on it in private operation is $677.50. The lowest registration fee on this combination, $45.00, is found in Colorado; the highest, $640.00, in Illinois. The average registration fee is $255.83, somewhat lower than on the three-axle single-unit truck (No. 6) of the same gross weight.

As an interesting sidelight, table 9 shows for this combination, in private operation, the taxes levied on the tractor-truck and on the semitrailer as individual units. The ratio of the taxes on the component units varies widely among the States: in Minnesota, for example, the $10.00 tax on the semitrailer is little more than 1 percent of the $750.00 levied on the tractor, while in Oklahoma the $295.50 for the semitrailer is 50 percent of the $585.50 for the power unit.

Vehicle No. 8, 50,000-pound gasoline-powered combination (table 11; fig. 18).—The 50,000-pound combination is legal in all States except Pennsylvania, Kentucky, and Tennessee, and can be operated in those States with reduced loads. The average registration fee for this combination is $341.17 when in private service, but in contract service the average registration fee is $586.70. The highest annual total of road-user taxes in private service is $1,637.50, but in contract service the highest total of road-user taxes is $2,555.25.

Figure 10 (p. 143) compares, for this combination and for the 40,000-pound combination, the tax costs in cents per mile of private and contract operation.

Vehicle No. 9, 50,000-pound diesel-powered combination (table 12; fig. 19).—The 50,000-pound diesel-powered combination, empty, is somewhat heavier than the 50,000-pound gasoline combination and thus carries a correspondingly smaller payload when at full capacity. (It is also a somewhat more expensive combination than the one with gasoline power and is subject to greater property taxes in many States.) Offset against this, however, is its substantial saving in total fuel cost, including tax. The diesel combination is assumed to save one-third in fuel gallonage. The saving in fuel is highly desirable from almost any standpoint, but the resulting reductions in

Table 10.—Road-user and personal-property taxes on a three-axle tractor-semitrailer combination, 40,000 pounds gross vehicle weight (No. 7)

State	Private operation							Contract carrier							
						Rank of State								Rank of State	
	Registration fee	Property tax	Other taxes and fees	Gasoline tax	Total	Total fees and taxes	Total, excl. Property tax	Registration fee	Property tax	Other taxes and fees	Carrier taxes and fees	Gasoline tax	Total	Total fees and taxes	Total, excl. prop tax
New England:															
Maine	$305.00	$151.28	....	$480.00	$936.28	7	13	$305.00	$151.28	....	$10.00	$480.00	$946.28	21	25
New Hampshire	240.00	94.52	....	400.00	734.52	27	26	240.00	94.52	....	2.00	400.00	736.52	38	36
Vermont	435.00	....	....	400.00	835.00	17	10	435.00	....	....	....	400.00	835.00	29	22
Massachusetts	122.00	210.04	....	400.00	732.04	30	42	122.00	210.04	....	5.00	400.00	737.04	37	44
Rhode Island	129.00	247.00	....	320.00	696.00	32	47	129.00	247.00	....	5.00	320.00	701.00	41	47
Connecticut	200.00	240.29	....	320.00	760.29	24	44	200.00	240.29	....	5.00	320.00	765.29	35	45
Middle Atlantic:															
New York	178.25	....	$370.00	320.00	868.25	14	7	178.25	....	....	370.00	320.00	868.25	28	19
New Jersey	200.00	....	2.00	240.00	442.00	48	48	200.00	....	$2.00	....	240.00	442.00	48	48
Pennsylvania	195.00	....	....	400.00	595.00	44	31	195.00	....	....	184.00	400.00	779.00	33	26
Delaware	150.00	....	....	400.00	550.00	46	36	150.00	....	....	....	400.00	550.00	47	42
Maryland	135.00	45.00	....	400.00	580.00	45	40	135.00	45.00	....	....	400.00	580.00	46	43
District of Columbia	115.00	145.90	....	400.00	660.90	34	45	115.00	145.90	....	....	400.00	660.90	43	46
West Virginia	242.00	262.55	....	400.00	904.55	10	23	242.00	262.55	....	38.00	400.00	942.55	22	33
Southeastern:															
Virginia	180.00	141.68	....	480.00	801.68	20	21	180.00	141.68	....	460.00	480.00	1,261.68	3	6
North Carolina	320.00	140.88	....	560.00	1,020.88	5	6	560.00	140.88	....	....	560.00	1,260.88	4	5
South Carolina	162.00	177.00	....	560.00	899.00	12	20	162.00	177.00	....	350.00	560.00	1,249.00	5	11
Georgia	120.00	132.68	....	480.00	732.68	29	29	237.50	132.68	....	25.00	480.00	875.18	27	29
Florida	197.50	....	.50	560.00	758.00	26	16	422.50	....	.50	200.50	560.00	1,183.50	9	2
Kentucky	350.00	211.62	.75	560.00	1,122.37	1	3	150.00	211.62	.50	320.00	560.00	1,242.12	6	14
Tennessee	275.00	....	.50	560.00	835.50	16	9	400.00	....	.50	17.50	560.00	978.00	18	15
Alabama	75.00	90.45	1.00	480.00	646.45	36	35	75.00	90.45	1.00	301.00	480.00	947.45	20	21
Mississippi	282.00	107.61	....	560.00	949.61	6	8	552.00	107.61	....	13.00	560.00	1,232.61	7	4
East Central:															
Ohio	312.40	....	....	320.00	632.40	39	27	312.40	....	....	30.00	320.00	662.40	42	34
Indiana	215.00	371.32	.25	320.00	906.57	9	39	215.00	371.32	.25	24.00	320.00	930.57	24	41
Illinois	640.00	78.75	....	400.00	1,118.75	2	1	640.00	78.75	....	....	400.00	1,118.75	11	12
Michigan	281.75	....	....	360.00	641.75	38	24	281.75	....	....	120.00	360.00	761.75	36	28
Wisconsin	227.50	....	....	320.00	547.50	47	37	227.50	....	....	560.00	320.00	1,107.50	12	7
Minnesota	360.00	....	....	400.00	760.00	25	15	360.00	....	....	7.50	400.00	767.50	34	27
Iowa	495.00	....	....	320.00	815.00	19	12	495.00	....	....	5.00	320.00	820.00	30	23
Missouri	307.00	48.12	....	240.00	595.12	43	38	307.00	48.12	....	25.00	240.00	620.12	44	39
Southwestern:															
Arkansas	205.00	63.96	....	520.00	788.96	21	18	205.00	63.96	....	....	520.00	788.96	32	30
Louisiana	260.00	....	....	560.00	820.00	18	11	520.00	....	....	10.00	560.00	1,090.00	13	10
Oklahoma	360.00	....	1.00	520.00	881.00	13	5	360.00	....	1.00	....	520.00	881.00	26	18
Texas	271.00	101.46	....	320.00	692.46	33	32	271.00	101.46	....	11.00	320.00	703.46	40	37
West Central:															
North Dakota	400.00	....	100.00	400.00	900.00	11	4	400.00	....	100.00	50.00	400.00	950.00	19	16
South Dakota	222.50	....	400.00	400.00	1,022.50	4	2	222.50	....	400.00	10.00	400.00	1,032.50	15	13
Nebraska	241.00	272.12	....	400.00	913.12	8	25	241.00	272.12	....	20.00	400.00	933.12	23	35
Kansas	130.00	138.00	200.00	400.00	868.00	15	17	130.00	138.00	....	400.00	400.00	1,068.00	14	17
Mountain:															
Montana	92.50	214.85	....	480.00	787.35	22	33	92.50	214.85	....	125.00	480.00	912.35	25	32
Idaho	119.00	....	....	480.00	599.00	42	30	119.00	....	....	....	480.00	599.00	45	38
Wyoming	90.00	126.02	....	400.00	616.02	41	46	90.00	126.02	....	369.50	400.00	985.52	17	20
Colorado	45.00	126.02	1.00	480.00	652.02	35	41	45.00	126.02	1.00	570.00	480.00	1,222.02	8	8
New Mexico	162.50	....	....	480.00	642.50	37	22	81.25	....	....	600.00	480.00	1,161.25	10	3
Arizona	120.45	189.00	....	400.00	709.45	31	43	120.45	189.00	....	575.00	400.00	1,284.45	1	9
Utah	160.00	173.60	....	400.00	733.60	28	34	160.00	173.60	....	....	400.00	733.60	39	40
Nevada	72.45	300.57	289.55	360.00	1,022.57	3	19	72.45	300.57	....	289.55	360.00	1,022.57	16	31
Pacific:															
Washington	160.00	....	85.75	520.00	765.75	23	14	160.00	....	85.75	36.00	520.00	801.75	31	24
Oregon	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
California	147.00	....	123.00	360.00	630.00	40	28	147.00	....	123.00	645.00	360.00	1,275.00	2	1

fuel tax contributions for the support of highways poses a problem. Michigan, Mississippi, New York, and Texas have already imposed higher rates on diesel fuel in an effort to obtain a tax contribution similar to that of gasoline-powered vehicles. Vermont and Nebraska do not tax diesel fuel but do impose equalization fees. Idaho does not levy any tax on diesel fuel consumed by vehicles subject to the mileage tax, but the mileage tax on diesel-powered vehicles is higher than on gasoline-powered vehicles. The relation between taxes paid on a gasoline-powered combination of 50,000 pounds gross weight and a similar diesel-powered combination may be developed by comparison of data in tables 11 and 12 (upper section).

Vehicle No. 10, 64,000-pound combination, and vehicle No. 11, 72,000-pound combination (table 12; figs. 20 and 21).—The heavy combinations are permitted in relatively few States. Where they are permitted, the taxes imposed are sometimes related to the effect of the vehicles on highway capacity, bridge load limits, acceptability of the vehicles from a traffic standpoint, and other factors not entirely concerned with the need for revenue. Since the taxation of such heavy combinations poses special problems in each State, further discussion is omitted here.

Comparisons between the taxes on private and contract carriers on a cents-per-mile basis are shown in figure 11 (p. 143).

Some Observations

Although the essential value of this study lies in the tables and charts, there are several items that merit special mention. These cannot be classed as new information, but they are put into perspective and measured.

Types of service.—Aside from the substantial differences in the computation of road-user taxes in the several States, there are very great differences in the levies on similar vehicles in different service. The vehicle of the private operator imposes the same burdens on the highway as the corresponding vehicle of the for-hire carrier, yet he does not pay nearly as much per mile in taxes in most States. It is notable that there is no difference between the taxation of for-hire and private carriers under the new mileage taxes in Idaho and New York.

Farm rates.—The registration fee reductions for farm trucks are substantial. It is doubtful whether these allowances can be fully justified from a highway finance standpoint, even though farm vehicles may travel fewer miles than other vehicles. The justification therefore must come under the heading of public policy and any State with farm rate reductions should carefully examine their relationship to other registration fees.

Diesel vehicles.—There is much evidence that, in general, diesel vehicles are making smaller tax contributions for highways in most States than corresponding gasoline-powered vehicles. The diesel vehicle is commonly assumed to use about two-thirds as much fuel as its gasoline-powered

Table 11.—Road-user and personal-property taxes on a gasoline-powered, four-axle, tractor-semitrailer combination, 50,000 pounds gross vehicle weight (No. 8)

State	Private operation							Contract carrier							
						Rank of State								Rank of State	
	Registration fee	Property tax	Other taxes and fees	Gasoline tax	Total	Total fees and taxes	Total, excl. property tax	Registration fee	Property tax	Other taxes and fees	Carrier taxes and fees	Gasoline tax	Total	Total fees and taxes	Total, excl. prop. tax
New England:															
Maine	$355.00	$192.38	....	$975.00	$1,522.38	10	15	$355.00	$192.38	....	$10.00	$975.00	$1,532.38	22	24
New Hampshire	300.00	118.91	....	812.50	1,231.41	25	26	300.00	118.91	....	2.00	812.50	1,233.41	33	32
Vermont	540.00	....	....	812.50	1,352.50	20	14	540.00	....	....	....	812.50	1,352.50	28	23
Massachusetts	152.00	264.24	....	812.50	1,228.74	26	37	152.00	264.24	....	5.00	812.50	1,233.74	32	40
Rhode Island	152.00	310.00	....	650.00	1,112.00	35	44	152.00	310.00	....	5.00	650.00	1,117.00	39	44
Connecticut	250.00	302.29	....	650.00	1,202.29	27	43	250.00	302.29	....	5.00	650.00	1,207.29	35	43
Middle Atlantic:															
New York	214.00	....	$747.50	650.00	1,611.50	6	2	214.00	....	....	747.50	650.00	1,611.50	18	14
New Jersey	260.00	....	2.00	487.50	749.50	45	45	260.00	....	$2.00	....	487.50	749.50	45	45
Pennsylvania	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Delaware	190.00	....	....	812.50	1,002.50	42	32	190.00	....	....	....	812.50	1,002.50	44	37
Maryland	210.00	55.00	....	812.50	1,077.50	37	31	210.00	55.00	....	....	812.50	1,077.50	42	34
Dist. of Columbia	130.00	185.40	....	812.50	1,127.90	33	39	130.00	185.40	....	....	812.50	1,127.90	37	41
West Virginia	317.00	330.30	....	812.50	1,459.80	14	23	317.00	330.30	....	47.00	812.50	1,506.80	23	29
Southeastern:															
Virginia	300.00	177.98	....	975.00	1,452.98	15	17	300.00	177.98	....	1,040.00	975.00	2,492.98	3	3
North Carolina	400.00	139.28	....	1,137.50	1,676.78	3	7	700.00	139.28	....	....	1,137.50	1,976.78	8	8
South Carolina	282.00	237.00	....	1,137.50	1,656.50	4	11	282.00	237.00	....	400.00	1,137.50	2,056.50	5	10
Georgia	170.00	202.40	....	975.00	1,347.40	21	20	337.50	202.40	....	25.00	975.00	1,539.90	21	25
Florida	214.50	....	.50	1,137.50	1,352.50	19	13	391.00	....	.50	325.50	1,137.50	1,854.50	10	6
Kentucky	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Tennessee	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Alabama	75.00	119.73	1.00	975.00	1,170.73	31	27	75.00	119.73	1.00	488.50	975.00	1,659.23	16	19
Mississippi	333.00	132.06	....	1,137.50	1,602.56	7	9	654.00	132.06	....	13.00	1,137.50	1,936.56	9	11
East Central:															
Ohio	334.80	....	....	650.00	984.80	43	36	334.80	....	....	30.00	650.00	1,014.80	43	36
Indiana	265.00	366.69	.25	650.00	1,281.94	23	41	265.00	366.69	.25	24.00	650.00	1,305.94	30	42
Illinois	789.00	84.69	....	812.50	1,686.19	2	3	789.00	84.69	....	....	812.50	1,686.19	14	15
Michigan	299.25	....	....	731.25	1,030.50	41	30	299.25	....	....	195.00	731.25	1,225.50	34	28
Wisconsin	290.00	....	....	650.00	940.00	44	40	290.00	....	....	710.00	650.00	1,650.00	17	13
Minnesota	510.00	....	....	812.50	1,322.50	22	16	510.00	....	....	7.50	812.50	1,330.00	29	26
Iowa	595.00	....	....	650.00	1,245.00	24	18	595.00	....	....	5.00	650.00	1,250.00	31	27
Missouri	507.00	60.15	....	487.50	1,054.65	39	33	507.00	60.15	....	25.00	487.50	1,079.65	41	35
Southwestern:															
Arkansas	330.00	87.96	....	1,056.25	1,474.21	13	12	330.00	87.96	....	....	1,056.25	1,474.21	26	22
Louisiana	340.00	....	....	1,137.50	1,477.50	12	8	680.00	....	....	10.00	1,137.50	1,827.50	11	9
Oklahoma	485.00	....	1.00	1,056.25	1,542.25	9	6	485.00	....	1.00	....	1,056.25	1,542.25	20	18
Texas	337.00	118.23	....	650.00	1,105.23	36	35	337.00	118.23	....	11.00	650.00	1,116.23	40	38
West Central:															
North Dakota	700.00	....	125.00	812.50	1,637.50	5	1	700.00	....	125.00	50.00	812.50	1,687.50	13	12
South Dakota	192.50	....	565.00	812.50	1,570.00	8	5	192.50	....	565.00	10.00	812.50	1,580.00	19	16
Nebraska	321.00	295.49	....	812.50	1,428.99	17	22	321.00	295.49	....	20.00	812.50	1,448.99	27	30
Kansas	225.00	167.00	562.50	812.50	1,767.00	1	4	225.00	167.00	....	812.50	812.50	2,017.00	7	7
Mountain:															
Montana	166.25	269.93	....	975.00	1,411.18	18	21	166.25	269.93	....	270.00	975.00	1,681.18	15	21
Idaho	151.00	....	....	975.00	1,126.00	34	24	151.00	....	....	....	975.00	1,126.00	38	31
Wyoming	100.00	158.54	....	812.50	1,071.04	38	42	100.00	158.54	....	636.44	812.50	1,707.48	12	17
Colorado	65.00	158.54	1.00	975.00	1,199.54	28	29	65.00	158.54	1.00	1,390.00	975.00	2,589.54	1	2
New Mexico	184.50	....	....	975.00	1,159.50	32	19	92.25	....	....	975.00	975.00	2,042.25	6	5
Arizona	135.25	237.80	....	812.50	1,185.55	29	38	135.25	237.80	....	1,300.00	812.50	2,485.55	4	4
Utah	175.00	190.34	....	812.50	1,177.84	30	34	175.00	190.34	....	....	812.50	1,177.84	36	39
Nevada	76.95	378.13	305.05	731.25	1,491.38	11	25	76.95	378.13	....	305.05	731.25	1,491.38	24	33
Pacific:															
Washington	295.00	....	89.00	1,056.25	1,440.25	16	10	295.00	....	89.00	41.00	1,056.25	1,481.25	25	20
Oregon	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
California	162.00	....	152.00	731.25	1,045.25	40	28	162.00	....	152.00	1,510.00	731.25	2,555.25	2	1

counterpart. Consequently, in States where diesel fuel is taxed at the same rate as gasoline and there are no other special taxes on diesel vehicles, the annual saving to the operator in taxes paid is substantial. In the example used in this study (comparison of vehicles Nos. 8 and 9), the saving amounts to approximately $270 per year.

Distribution of vehicles.—Only 2 percent of our vehicles are trucks of 40,000 pounds or more capacity. The taxes paid by all classes of vehicles, including heavy trucks, should constantly be subject to review and adjustment, but from a practical standpoint the bulk of the revenue for highways must inevitably come from the automobiles and lighter trucks that constitute the vast majority of vehicles.

(Table 12 and figures 10-21 follow.)

Table 12.—Road-user and personal-property taxes on heavy combinations (diesel-powered)

State	Private operation							Contract carrier							
						Rank of State								Rank of State	
	Registration fee	Property tax	Other taxes and fees	Diesel fuel tax	Total	Total fees and taxes	Total, excl. prop. tax	Registration fee	Property tax	Other taxes and fees	Carrier taxes and fees	Diesel fuel tax	Total	Total fees and taxes	Total, excl. prop. tax
FOUR-AXLE TRACTOR-SEMITRAILER COMBINATION, 50,000 POUNDS GROSS VEHICLE WEIGHT (NO. 9)															
New England:															
Maine	$355.00	$249.09	...	$649.98	$1,254.07	14	20	$355.00	$249.09	...	$10.00	$649.98	$1,264.07	25	30
New Hampshire	300.00	155.32	...	541.65	996.97	30	27	300.00	155.32	...	2.00	541.65	998.97	38	35
Vermont	1,065.00	...	...	...	1,065.00	24	13	1,065.00	...	...	...	...	1,065.00	34	25
Massachusetts	152.00	345.16	...	541.65	1,038.81	27	40	152.00	345.16	...	5.00	541.65	1,043.81	36	42
Rhode Island	152.00	406.00	...	433.32	991.32	31	44	152.00	406.00	...	5.00	433.32	996.32	39	44
Connecticut	250.00	394.86	...	433.32	1,078.18	22	42	250.00	394.86	...	5.00	433.32	1,083.18	32	43
Middle Atlantic:															
New York	220.50	...	$747.50	649.98	1,617.98	1	1	220.50	...	...	747.50	649.98	1,617.98	10	6
New Jersey	260.00	...	2.00	324.99	586.99	45	43	260.00	...	$2.00	...	324.99	586.99	45	45
Pennsylvania	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Delaware	190.00	...	...	541.65	731.65	43	35	190.00	...	...	...	541.65	731.65	44	40
Maryland	210.00	55.00	...	541.65	806.65	41	32	210.00	55.00	...	...	541.65	806.65	43	37
District of Columbia	195.00	231.00	...	541.65	967.65	34	34	195.00	231.00	...	...	541.65	967.65	40	39
West Virginia	317.00	431.45	...	541.65	1,290.10	13	24	317.00	431.45	...	47.00	541.65	1,337.10	23	33
Southeastern:															
Virginia	300.00	231.44	...	649.98	1,181.42	19	23	300.00	231.44	...	1,000.00	649.98	2,181.42	4	3
North Carolina	400.00	216.46	...	758.31	1,374.77	8	10	700.00	216.46	...	...	758.31	1,674.77	9	11
South Carolina	282.00	311.00	...	758.31	1,351.31	11	15	282.00	311.00	...	400.00	758.31	1,751.31	6	13
Georgia	170.00	244.86	...	649.98	1,064.84	25	30	337.50	244.86	...	25.00	649.98	1,257.34	26	31
Florida	230.00	...	.50	758.31	988.81	32	21	416.25	...	50	325.50	758.31	1,500.56	12	10
Kentucky	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Tennessee	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Alabama	75.00	155.24	1.00	649.98	881.22	37	36	75.00	155.24	1.00	488.50	649.98	1,369.72	22	20
Mississippi	333.00	171.32	...	866.64	1,370.96	9	7	654.00	171.32	...	13.00	866.64	1,704.96	8	8
East Central:															
Ohio	376.80	...	...	433.32	810.12	40	31	376.80	...	...	30.00	433.32	840.12	42	36
Indiana	265.00	603.82	.25	433.32	1,302.39	12	39	265.00	603.82	.25	24.00	433.32	1,326.39	24	41
Illinois	789.00	93.57	...	541.65	1,424.22	5	5	789.00	93.57	...	...	541.65	1,424.22	18	17
Michigan	323.75	...	...	649.98	973.73	33	22	323.75	...	...	195.00	649.98	1,168.73	30	22
Wisconsin	290.00	...	...	433.32	723.32	44	37	290.00	...	...	710.00	433.32	1,433.32	17	14
Minnesota	510.00	...	...	541.65	1,051.65	26	14	510.00	...	...	7.50	541.65	1,059.15	35	26
Iowa	595.00	...	...	433.32	1,028.32	28	18	595.00	...	...	5.00	433.32	1,033 32	37	29
Missouri	507.00	60.15	...	324.99	892.14	36	29	507.00	60.15	...	25.00	324.99	917.14	41	34
Southwestern:															
Arkansas	330.00	87.96	...	704.15	1,122.11	20	16	330.00	87.96	...	...	704.15	1,122.11	31	28
Louisiana	340.00	...	...	758.31	1,098.31	21	12	680.00	...	...	10.00	758.31	1,448.31	15	12
Oklahoma	485.00	...	1.00	704.15	1,190.15	16	9	485.00	...	1.00	...	704.15	1,190.15	29	21
Texas	382.50	152.39	...	649.98	1,184.87	18	17	382.50	152.39	...	11.00	649.98	1,195.87	28	27
West Central:															
North Dakota	700.00	...	125.00	541.65	1,366.65	10	4	700.00	...	125.00	50.00	541.65	1,416.65	21	16
South Dakota	242.50	...	630.00	541.65	1,414.15	6	3	242.50	...	630.00	10.00	541.65	1,424.15	19	15
Nebraska	321.00	282.11	800.00	...	1,403.11	7	11	321.00	282.11	800.00	20.00	...	1,423.11	20	23
Kansas	225.00	217.00	562.50	541.65	1,546.15	2	6	225.00	217.00	...	812.50	541.65	1,796.15	5	7
Mountain:															
Montana	186.25	352.98	...	649.98	1,189.21	17	28	186.25	352.98	...	260.00	649.98	1,449.21	14	24
Idaho	78.00	...	1,446.90	...	1,524.90	3	2	78.00	...	...	1,446.90	...	1,524.90	11	9
Wyoming	110.00	207.09	...	433.32	750.41	42	45	110.00	207.09	...	685.60	433.32	1,436.01	16	19
Colorado	65.00	207.09	1.00	649.98	923.07	35	38	65.00	207.09	1.00	1,330.00	649.98	2,253.07	2	2
New Mexico	204.00	...	...	649.98	853.98	39	26	102.00	...	...	975.00	649.98	1,726.98	7	5
Arizona	145.75	310.60	...	541.65	998.00	29	41	145.75	310.60	...	1,250.00	541.65	2,248.00	3	4
Utah	195.00	339.76	...	541.65	1,076.41	23	33	195.00	339.76	...	...	541.65	1,076.41	33	38
Nevada	83.70	493.93	326.75	595.82	1,500.20	4	19	83.70	493.93	...	326.75	595.82	1,500.20	13	32
Pacific:															
Washington	370.00	...	122.25	704.15	1,196.40	15	8	370.00	...	122.25	42.00	704.15	1,238.40	27	18
Oregon	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
California	172.00	...	198.00	487.49	857.49	38	25	172.00	...	198.00	1,446.67	487.49	2,304.16	1	1
FIVE-AXLE TRACTOR-SEMITRAILER COMBINATION, 64,000 POUNDS GROSS VEHICLE WEIGHT (NO. 10)															
Maryland	$235.00	$60.00	...	$851.05	$1,146.05	20	18	$235.00	$60.00	...	...	$851.05	$1,146.05	20	19
District of Columbia	365.00	314.10	...	851.05	1,530.15	13	14	365.00	314.10	...	...	851.05	1,530.15	19	17
South Carolina	347.00	427.00	...	1,191.47	1,965.47	5	6	347.00	427.00	...	$400.00	1,191.47	2,365.47	6	11
Florida	295.50	...	$.50	1,191.47	1,487.47	15	9	601.50	...	$.50	400.50	1,191.47	2,193.97	11	7
Indiana	300.00	777.33	.25	680.84	1,758.42	8	19	300.00	777.33	.25	24.00	680.84	1,782.42	16	20
Michigan	479.75	...	...	1,021.26	1,501.01	14	8	479.75	...	...	320.00	1,021.26	1,821.01	15	12
Arkansas	455.00	87.96	...	1,106.37	1,649.33	10	5	455.00	87.96	...	...	1,106.37	1,649.33	18	14
Louisiana	400.00	...	...	1,191.47	1,591.47	11	4	800.00	...	...	10.00	1,191.47	2,001.47	13	8
South Dakota	642.50	...	730.00	851.05	2,223.55	2	2	642.50	...	730.00	10.00	851.05	2,233.55	8	6
Nebraska	401.00	651.95	1,000.00	...	2,052.95	4	10	401.00	651.95	1,000.00	20.00	...	2,072.95	12	16
Montana	336.25	469.99	...	1,021.26	1,827.50	7	11	336.25	469.99	...	400.00	1,021.26	2,227.50	9	13
Idaho	...	...	2,926.40	...	2,926.40	1	1	...	...	...	2,926.40	...	2,926.40	4	4
Wyoming	180.00	287.84	...	680.84	1,148.68	19	20	180.00	287.84	...	1,107.00	680.84	2,255.68	7	10
Colorado	100.00	287.84	1.00	1,021.26	1,410.10	16	16	100.00	287.84	1 00	2,170.00	1,021.26	3,580.10	2	2
New Mexico	304.50	...	...	1,021.26	1,325 76	18	13	152.25	...	...	1,200.00	1,021.26	2,373.51	5	5
Arizona	258.75	431.80	...	851.05	1,541.60	12	17	258.75	431.80	...	1,950.00	851.05	3,491.60	3	3
Utah	350.00	476.16	...	851.05	1,677.21	9	15	350.00	476.16	...	...	851.05	1,677.21	17	18
Nevada	113.40	686.51	485.75	936.16	2,221.82	3	7	113.40	686.51	...	487.75	936.16	2,221.82	10	15
Washington	662.50	...	171.75	1,106.37	1,940.62	6	3	662.50	...	171.75	47.00	1,106.37	1,987.62	14	9
Oregon	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
California	302.00	...	270.00	765.95	1,337.95	17	12	302.00	...	270.00	2,243.34	769.95	3,581.29	1	1
SIX-AXLE TRUCK AND FULL TRAILER COMBINATION, 72,000 POUNDS GROSS VEHICLE WEIGHT (NO. 11)															
Ohio	$703.75	...	...	$837.20	$1,540.95	10	7	$703.75	...	...	$20.00	$837.20	$1,560.95	12	11
Louisiana	520.00	...	...	1,465.10	1,985.10	5	3	1,040.00	...	...	10.00	1,465.10	2,515.10	9	7
Montana	422.50	$530.11	...	1,255.80	2,208.41	4	5	422.50	$530.11	...	490.00	1,255.80	2,698.41	7	9
Idaho	...	...	$3,427.20	...	3,427.20	1	1	...	...	...	3,427.20	...	3,427.20	5	5
Wyoming	220.00	310.79	...	837.20	1,367.99	12	12	220.00	310.79	...	1,688.50	837.20	3,056.49	6	6
Colorado	107.50	310.79	1.00	1,255.80	1,675.09	8	10	107.50	310.79	$1.00	2,800.00	1,255.80	4,475.09	1	2
New Mexico	334.50	...	...	1,255.80	1,590.30	9	6	167.25	...	...	2,700.00	1,255.80	4,123.05	4	3
Arizona	277.00	466.20	...	1,046.50	1,789.70	7	11	277.00	466.20	...	2,400.00	1,046.50	4,189.70	3	4
Utah	445.00	362.70	...	1,046.50	1,854.20	6	9	445.00	362.70	...	...	1,046.50	1,854.20	11	12
Nevada	129.60	741.23	628.50	1,151.15	2,650.48	2	4	129.60	741.23	...	628.50	1,151.15	2,650.48	8	10
Washington	842.50	...	180.25	1,360.45	2,383.20	3	2	842.50	...	180.25	50.00	1,360.45	2,433.20	10	8
Oregon	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
California	302.00	...	293.00	941.85	1,536.85	11	8	302.00	...	293.00	2,783.33	941.85	4,320.18	2	1

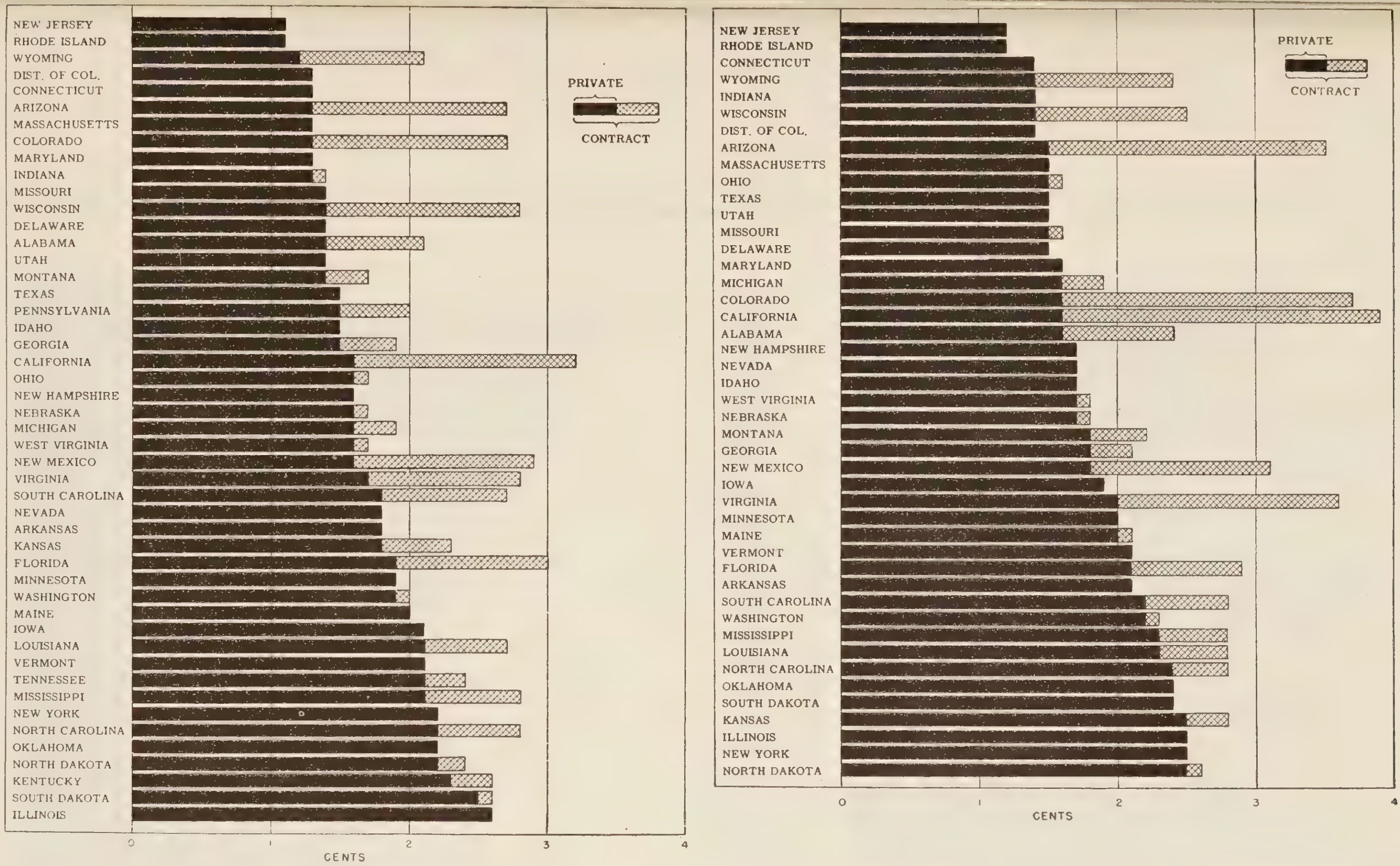
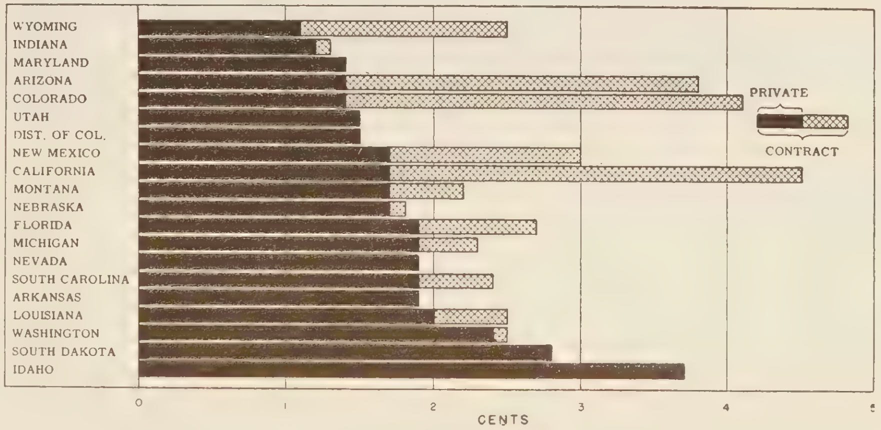


Figure 10.—Comparison of State road-user taxes (personal-property taxes not included), in cents per mile for private use and contract operation, for a 40,000-pound three-axle tractor-semitrailer (No. 7) (left) *and a 50,000-pound gasoline-powered four-axle tractor-semitrailer (No. 8)* (right).



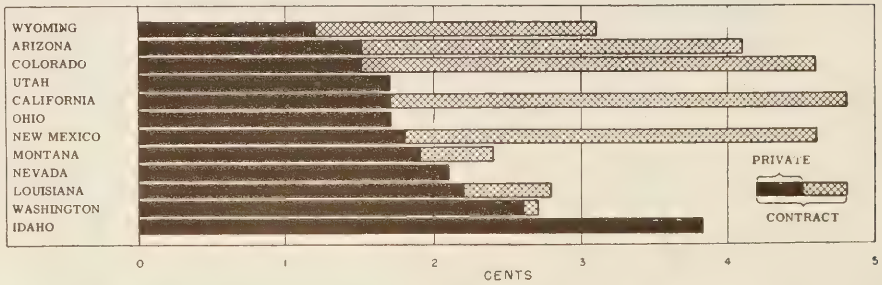


Figure 11.—Comparison of State road-user taxes (personal-property taxes not included) in cents per mile for private use and contract operation, for a 64,000-pound diesel-powered five-axle tractor-semitrailer (No. 10) (left) *and a 72,000-pound diesel-powered six-axle combination, truck and full trailer (No. 11)* (right).

LIGHT-WEIGHT PASSENGER CAR (No. 1)

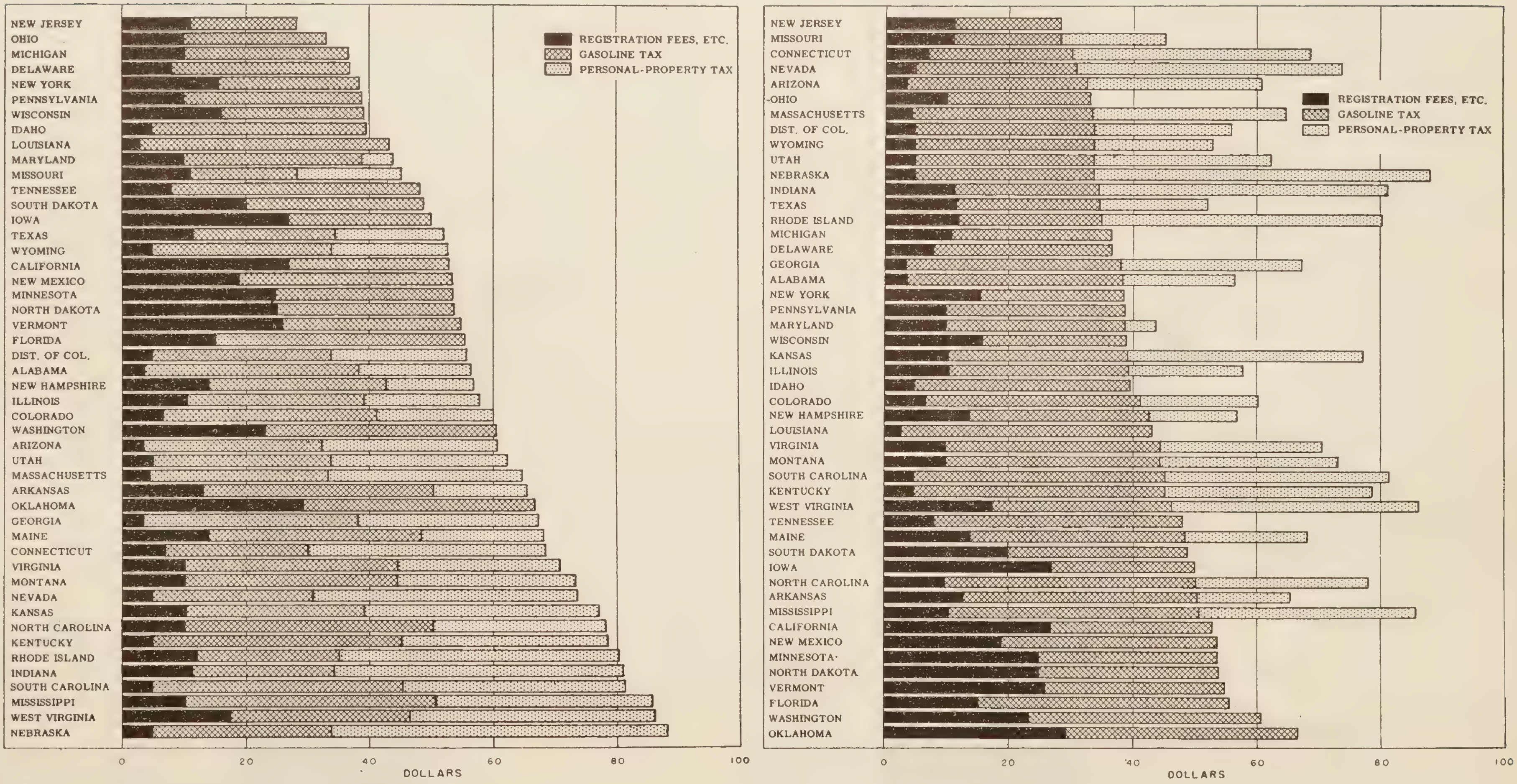


Figure 12.—State road-user and personal-property taxes on a light-weight passenger car (No. 1), ranked according to total taxes (left) and road-user taxes (right).

PICKUP TRUCK (No. 3)

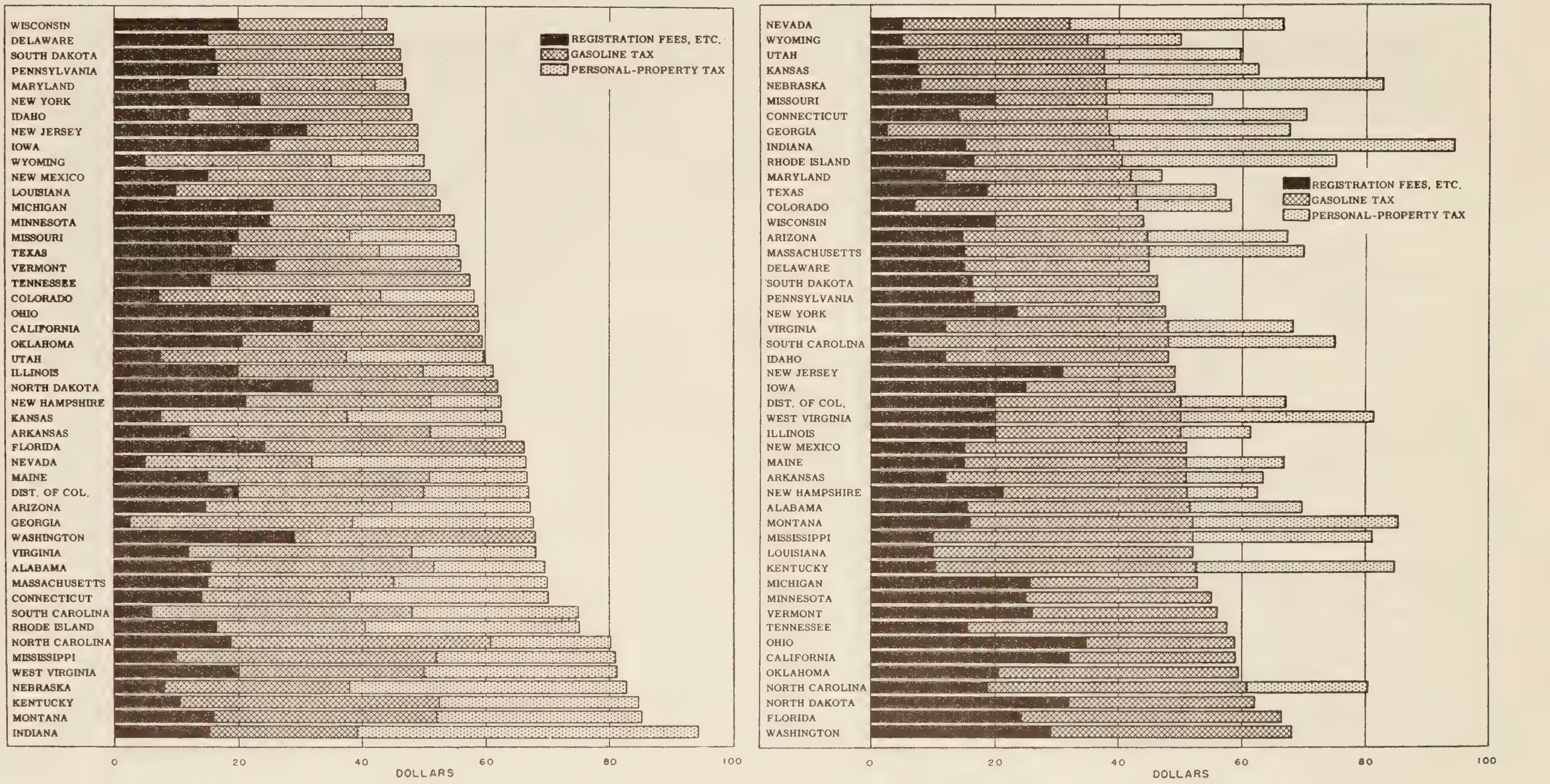


Figure 13.—State road-user and personal-property taxes on a pickup truck (No. 3) in private use, ranked according to total taxes (left) *and road-user taxes* (right).

12,500-POUND STAKE TRUCK (No. 4)

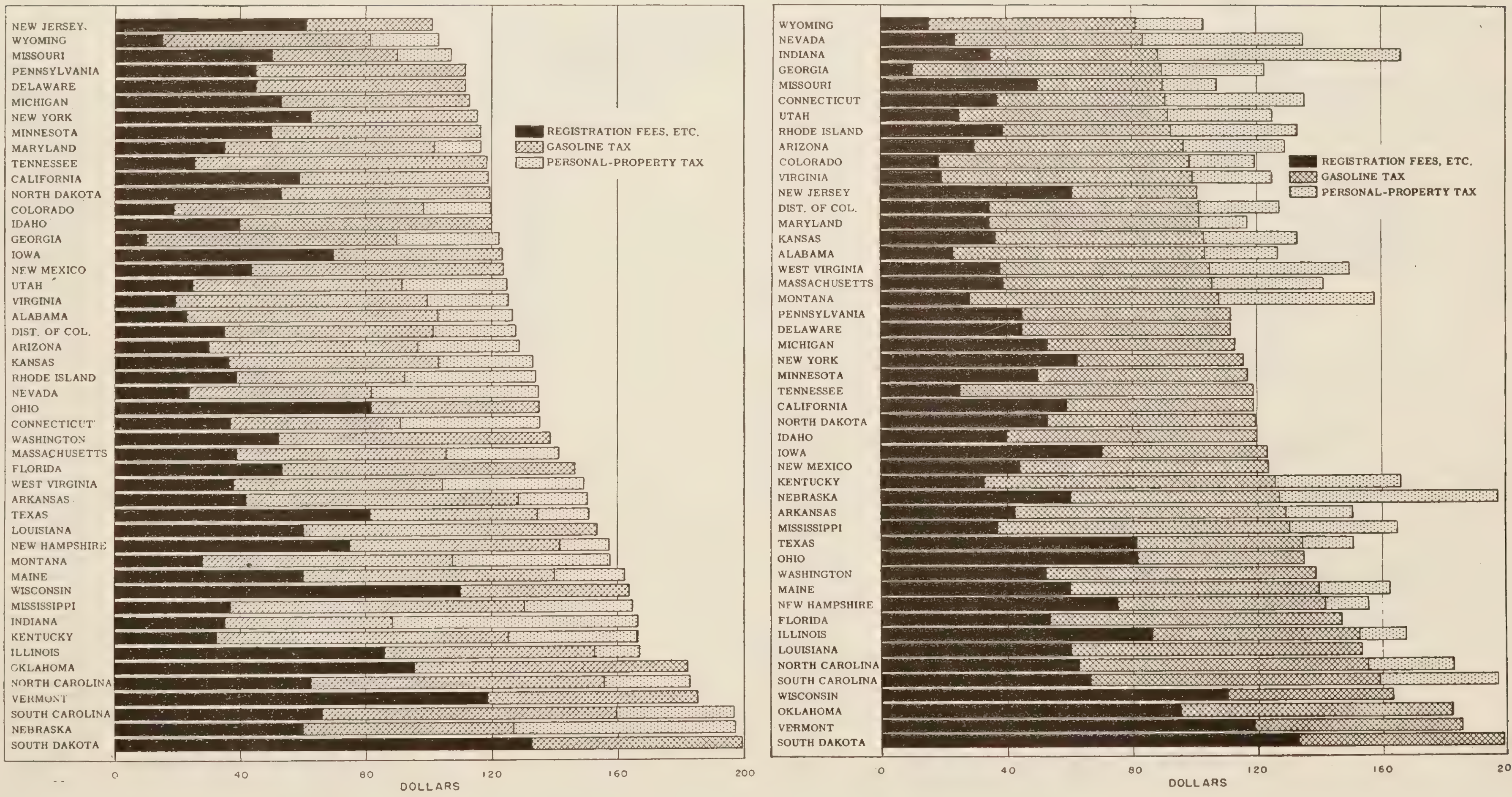


Fig. 14.—State road-user and personal-property taxes on a 12,500-pound stake truck (No. 4) in private use, ranked according to total taxes (left) *and road-user taxes* (right).

19,000-POUND VAN TRUCK (No. 5)

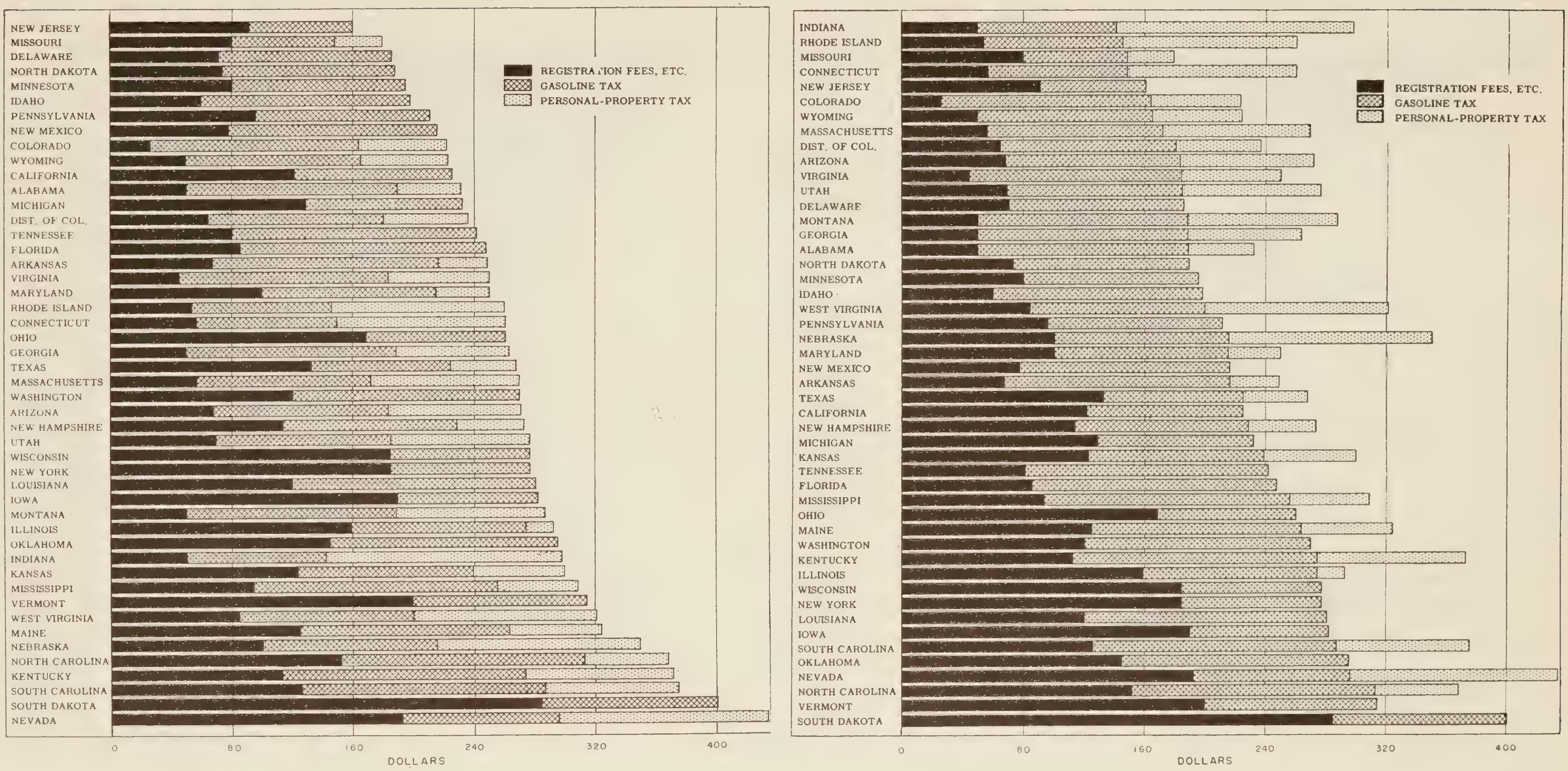


Figure 15.—State road-user and personal-property taxes on a 19,000-pound van truck (No. 5) in private use, ranked according to total taxes (left) and road-user taxes (right).

40,000-POUND TANDEM-AXLE DUMP TRUCK (No. 6)

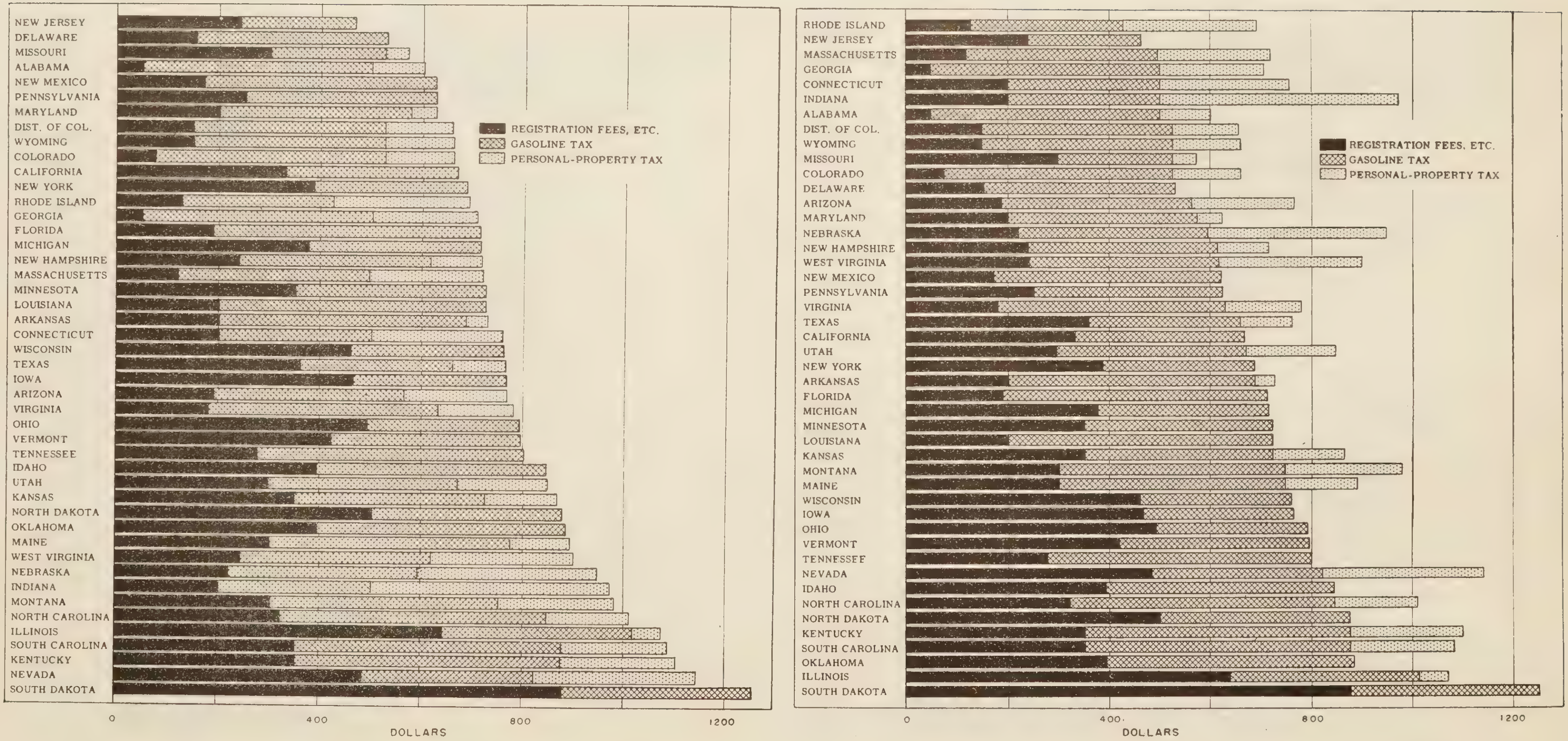


Figure 16.—State road-user and personal-property taxes on a 40,000-pound tandem-axle dump truck (No. 6) in private use, ranked according to total taxes (left) and road-user taxes (right).

40,000-POUND THREE-AXLE TRACTOR-SEMITRAILER (No. 7)

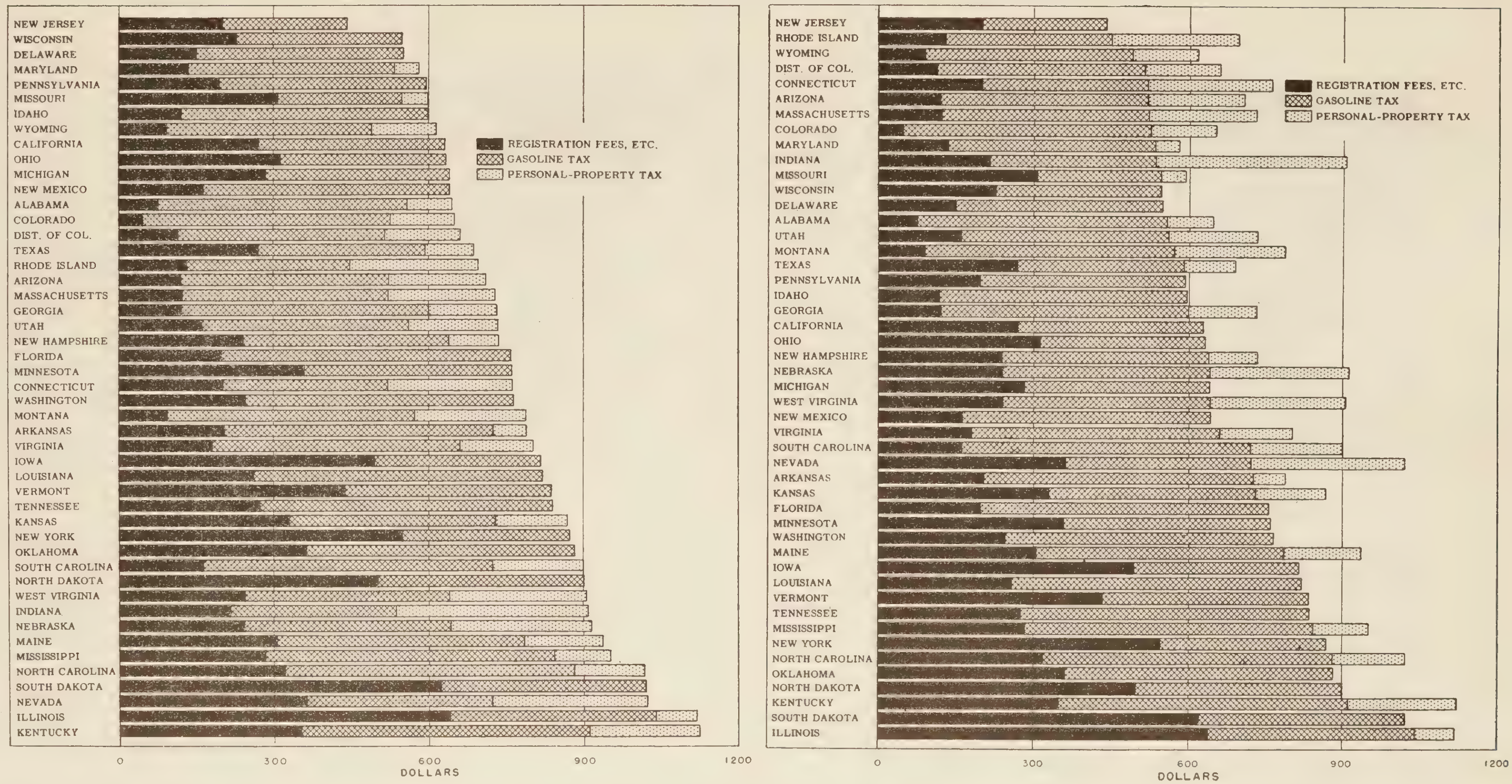


Figure 17.—State road-user and personal-property taxes on a 40,000-pound three-axle tractor-semitrailer combination (No. 7) in private use, ranked according to total taxes (left) and road-user taxes (right).

50,000-POUND GASOLINE-POWERED FOUR-AXLE TRACTOR-SEMITRAILER (No. 8)

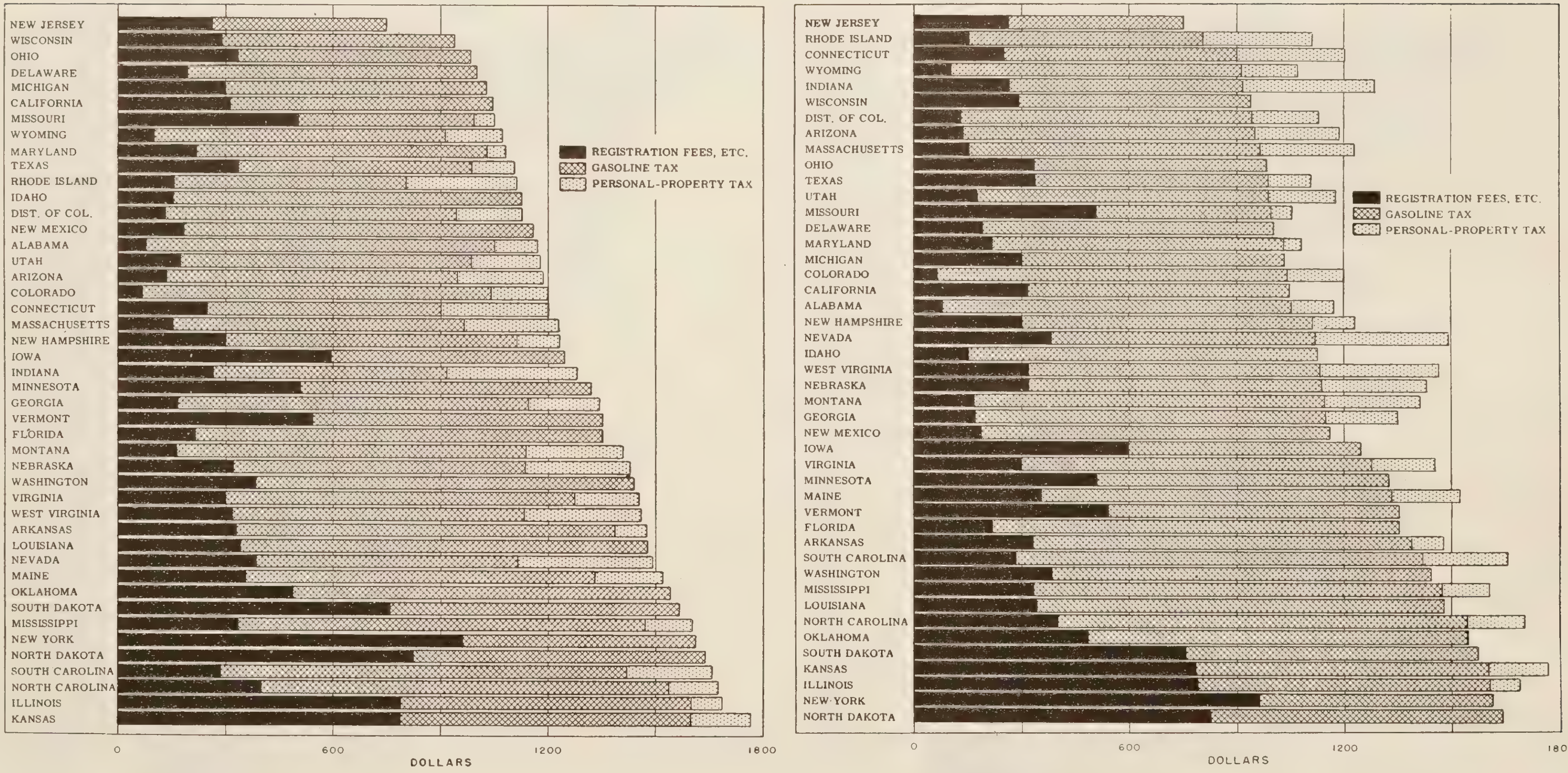


Figure 18.—State road-user and personal-property taxes on a 50,000-pound gasoline-powered four-axle tractor-semitrailer combination (No. 8) in private use, ranked according to total taxes (left) and road-user taxes (right).

50,000-POUND DIESEL-POWERED FOUR-AXLE TRACTOR-SEMITRAILER (No. 9)

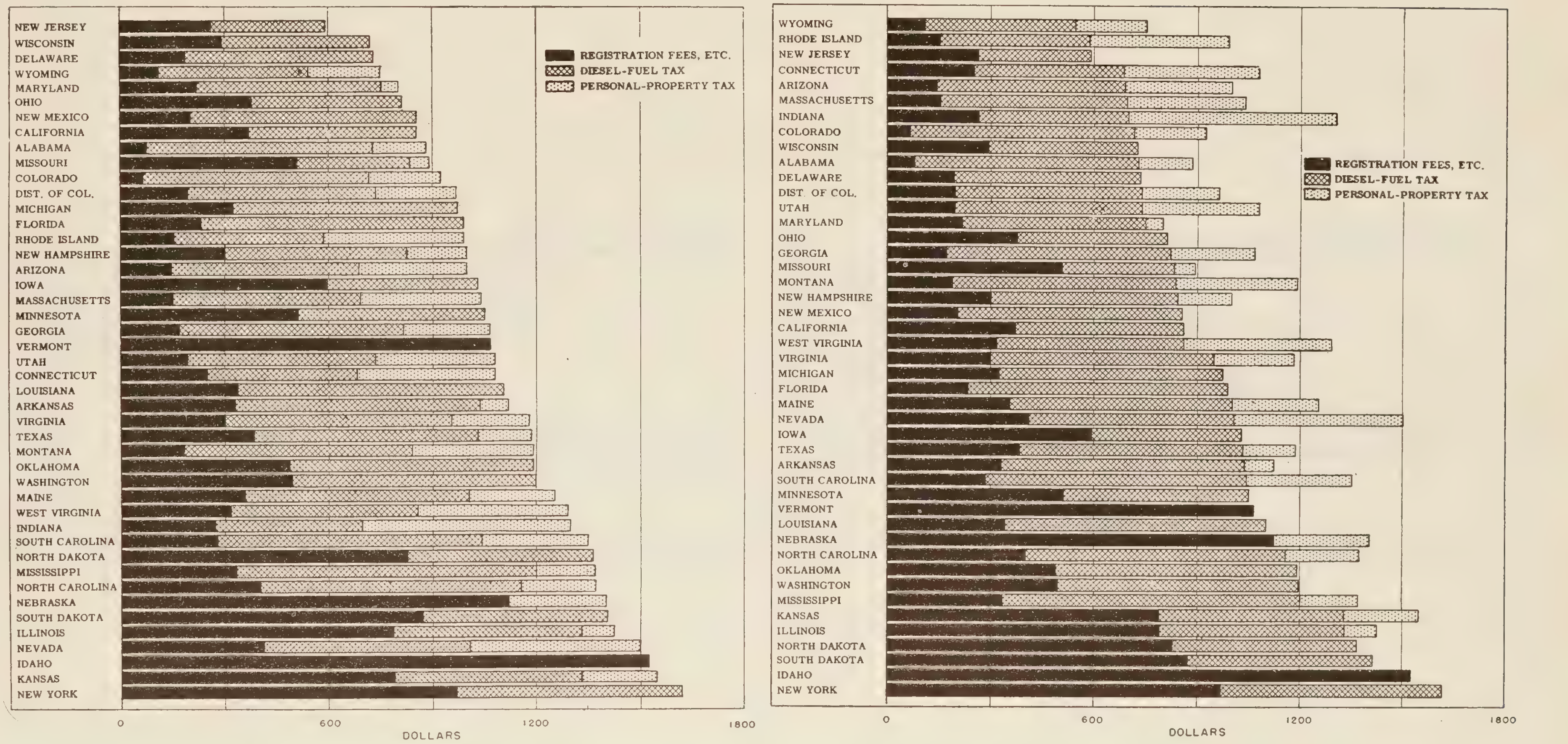


Figure 19.—State road-user and personal-property taxes on a 50,000-pound diesel-powered four-axle tractor-semitrailer combination (No. 9) in private use, ranked according to total taxes (left) and road-user taxes (right).

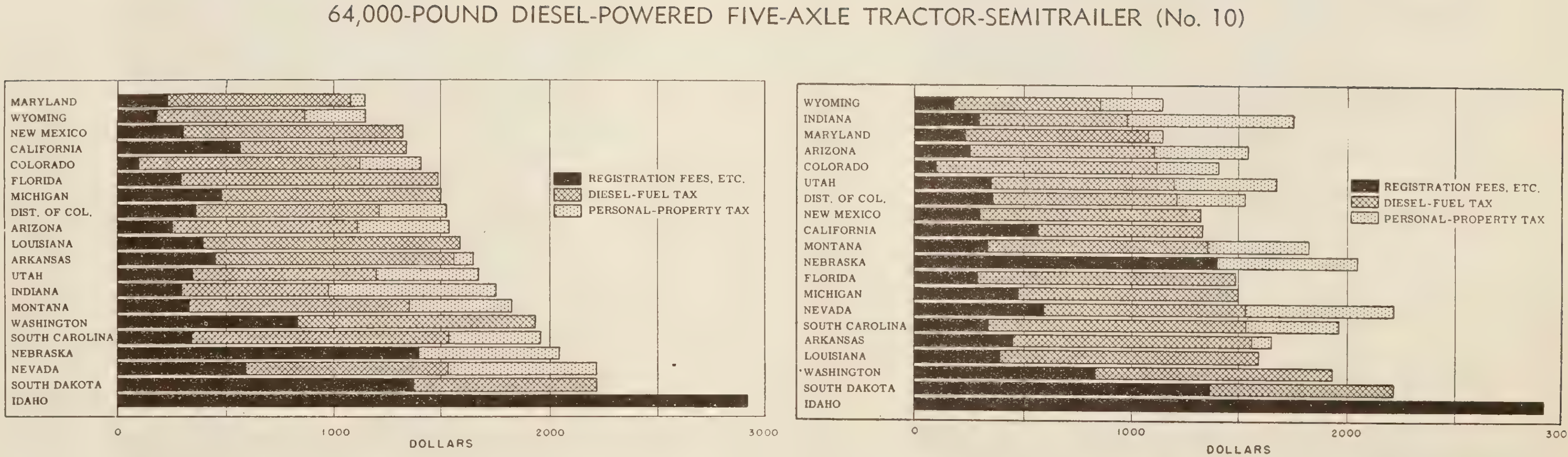


Figure 20.—State road-user and personal-property taxes on a 64,000 pound diesel-powered five-axle tractor-semitrailer combination (No. 10) in private use, ranked according to total taxes (left) *and road-user taxes* (right).

72,000-POUND DIESEL-POWERED SIX-AXLE TRUCK AND FULL TRAILER (No. 11)

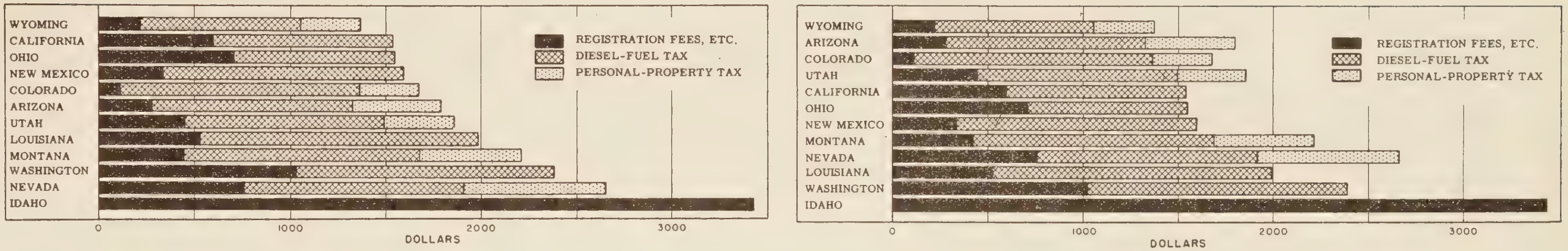


Figure 21.—State road-user and personal-property taxes on a 72,000-pound diesel-powered six-axle truck and full trailer combination (No. 11) in private use, ranked according to total taxes (left) *and road-user taxes* (right).

Plotting Aggregate Gradation Specifications for Bituminous Concrete

By JOHN B. DALHOUSE, Highway Engineer
North Carolina District Office
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Aggregate gradation specifications for bituminous concrete generally specify either the total percentages passing each sieve of a series or the percentages passing one sieve and retained on the next. Ready comparison of two dissimilar types has been considered impossible, largely because no practical means of plotting the second type for visual inspection has heretofore been developed.

In this article there is described a simple method for plotting the requirements of percentage passing and retained specifications, thereby permitting visualization of the nature of a specified gradation and comparison of it with the plotting of a total percentage passing gradation.

ALL SPECIFICATIONS for bituminous concrete set forth the gradation of materials to be used in the mix. Mineral aggregate gradation requirements in the various current specifications are of two general types. One specifies the total percentages passing each individual sieve in a given series, and the other specifies the percentages passing one sieve and retained on the next smaller sieve. Because of the dissimilarity between the two types, it has in the past generally been considered impossible to compare them by any ready means. An additional complication is the use of varying series of sieves in different specifications.

Some experienced engineers are able to determine, by reading of the specifications, just what kind of a mix will result from the requirements. To a great many engineers, however, the easiest means of visualizing the nature of a specified aggregate gradation is to plot it as a graph, preferably on semilogarithmic cross-section paper. A convenient form of aggregate chart is commonly used, with a percentage scale on the vertical axis and the sieve sizes in logarithmic scale on the horizontal axis.

The plotting is an easy operation for the percentage passing specifications, but has not heretofore been feasible by any simple method for specification requirements on a percentage passing and retained basis. The purpose of this report is to describe a method whereby this latter type of specification can be plotted.

Demonstration of Method

To demonstrate the method, the passing and retained aggregate gradation specification shown in table 1 is used in this report. It is to be understood that this is not considered as a typical or recommended gradation, but merely as a working example. Derivation of the plotting points is shown in table 2, and the curves drawn therefrom appear in figures 1 and 2.

The percentages of material passing and retained are given in table 1 as ranges, in the usual manner. These figures are, of course, minimum and maximum amounts. The first step in the procedure is to calculate from table 1 the cumulative percentages of material passing each sieve, using first the minimum limits throughout and second, the maximum limits starting with the smallest size sieve in the sieve series in each case. These cumulative series are entered respectively in columns 1 and 2 of table 2. For example, working upward from the bottom of table 1, the *minimum* cumulative amount passing the No. 200 sieve is 2 percent, that passing the No. 80 sieve is 2 + 7 = 9 percent, and so on (see column 1 of table 2). The *maximum* cumulative amount passing the No. 200 sieve is 8 percent, that passing the No. 80 sieve is 8 + 12 = 20 percent, and so on (see column 2 of table 2).

The minimum cumulative percentage passing values thus calculated are plotted in figure 1 as curve 1; the maximum values as curve 2. As indicated in table 2, column 2, certain of the calculated percentages may be greater than 100 percent and are disregarded in the plotting since they are fictional values. The two curves define the limits of the intended grading band in the fine sizes but they do not define them in the coarse sizes.

Table 1.—Assumed aggregate gradation requirements

Sieve size		Percentage of material
Passing	Retained on	
....	1 inch	0
1 inch	½ inch	25–45
½ inch	No. 4	10–25
No. 4	No. 8	6–15
No. 8	No. 16	6–9
No. 16	No. 40	8–13
No. 40	No. 80	7–13
No. 80	No. 200	7–12
No. 200	....	2–8

The second step in the procedure is to calculate from table 1 the cumulative percentages of material retained on each sieve, using first the minimum limits throughout and second, the maximum limits, starting with the maximum size sieve in the sieve series in each case. Enter these figures in columns 1R and 2R of table 2. Thus, working downward from the top of table 1, the *minimum* cumulative amount retained on the 1-inch sieve is 0, that retained on the ½-inch sieve is 25 percent, that retained on the No. 4 sieve is 25 + 10 = 35 percent, and so on (see column 1R of table 2). The *maximum* cumulative amount retained on the 1-inch sieve is 0, that retained on the

Table 2.—Cumulative percentages of aggregate gradation, and derived specification on a percentage passing basis

Sieve size	Cumulative percentage passing, by simple addition		Cumulative percentage retained		Cumulative percentage passing, by substraction		Derived specification on a percentage passing basis [1] (5)
	Minimum (1)	Maximum (2)	Minimum (1R)	Maximum (2R)	Maximum (3)	Minimum (4)	
1 inch	71	[2] 140	0	0	100	100	100
½ inch	46	95	25	45	75	55	55–75
No. 4	36	70	35	70	65	30	36–65
No. 8	30	55	41	85	59	15	30–55
No. 16	24	46	47	94	53	6	24–46
No. 40	16	33	55	[2] 107	45	[2] – 7	16–33
No. 80	9	20	62	[2] 120	38	[2] –20	9–20
No. 200	2	8	69	[2] 132	31	[2] –32	2-8

[1] The greater of the two minimum values, columns 1 and 4, and the lesser of the two maximum values, columns 2 and 3.

[2] Fictional values.

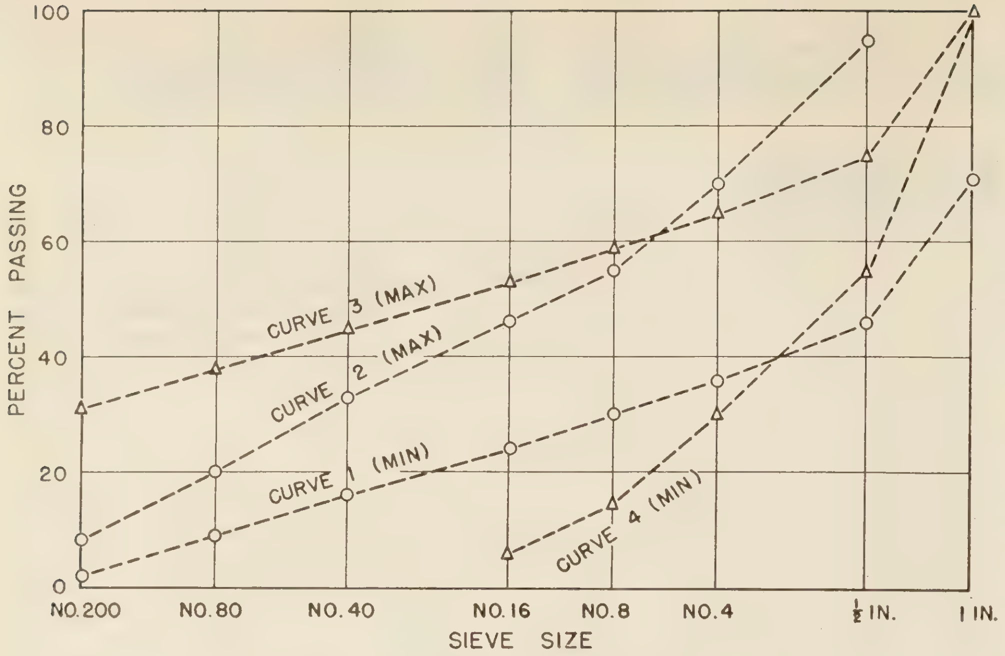

Figure 1.—Limiting curves of grading.

½-inch sieve is 45 percent, that retained on the No. 4 sieve is 45 + 25 = 70 percent, and so on (see column 2R of table 2).

In any grading analysis, when the percentage retained on any particular sieve is known, the percentage passing the same sieve can be determined simply by subtracting the percentage retained from 100. Thus, in table 2, columns 3 and 4 are derived from columns 1R and 2R. The values exceeding 100 percent in column 2R are fictional and, therefore, the negative values in column 4 are also fictional and are disregarded in plotting.

The maximum cumulative percentage passing values thus calculated (column 3, table 2) are plotted in figure 1 as curve 3; the minimum values (column 4, table 2) as curve 4. These two curves define the limits of the intended grading band in the coarse sizes but they do not define them in the fine sizes.

The third step is to select the lower values of curves 2 and 3 and connect these values by a solid line, as illustrated in figure 2. Similarly, the higher values of curves 1 and 4 are selected and connected by a solid line. These curves define the limits of the intended grading band.

As indicated in column 5 of table 2, an equivalent gradation on a percentage passing basis may be derived from the values computed in columns 1, 2, 3, and 4. The lowest maximum values (columns 2 and 3) and the highest minimum values (columns 1 and 4) are used. When plotted on an aggregate chart, these percentage passing values enclose an area identical in shape and size with that representing the passing and retained specification from which they are derived.

The grading band, so drawn, will enclose all possible gradings that fall within the limits of the passing and retained grading specification in table 1, and the derived percentage passing grading, in column 5 of table 2.

Control for each Sieve

The two specifications are not identical in their control, however, because of another factor. That is the requirement in the passing and retained specification, table 1, that for each fraction defined, there is a definite control of the amount of that which passes any particular sieve which must be retained on the next smaller sieve in the named series. This has the effect of placing maximum and minimum limits o the slope of each segment of any specif grading curve that might be drawn withi the borders of the grading band. Thes maximum and minimum slopes vary as th specific grading curve passes from zone t zone but they are definitely fixed, as follows

1. Minimum slopes are fixed by curve 1 and 3 which are parallel to each othe throughout (see fig. 2). Therefore, eac of the solid lines in the envelope curve tha represents a segment of either curve 1 o 3 establishes the minimum slope, under th passing and retained specification, for th zone in which it occurs.

2. Maximum slopes are fixed by curve 2 and 4 which also are parallel to each other throughout, including the fictiona segments not shown. Therefore, each of the solid lines in the envelope curve that represent a segment of either curve 2 or 4 establishes the maximum slope for its zone.

3. In the transition zone B, no segment of curves 1 or 4 was used as a part of the envelope curve. Likewise in zone C, no segment of curves 2 or 3 was used as a part of the envelope curve. In these zones proper control may be obtained by using the dashed segment of curve 1 to set the minimum permissible slope in zone B and the dashed segment of curve 4 to set the maximum permissible slope in that zone Similarly, the dashed segments of curves 3 and 2 establish the minimum and maximum slopes respectively in zone C. It might appear that this is not necessary and that it would be more practical to utilize the solid lines connecting Y with Z and V with X for the slope control, but this is not correct as may be seen by a close examination of the specification requirements.

It is evident, from the preceding dis-

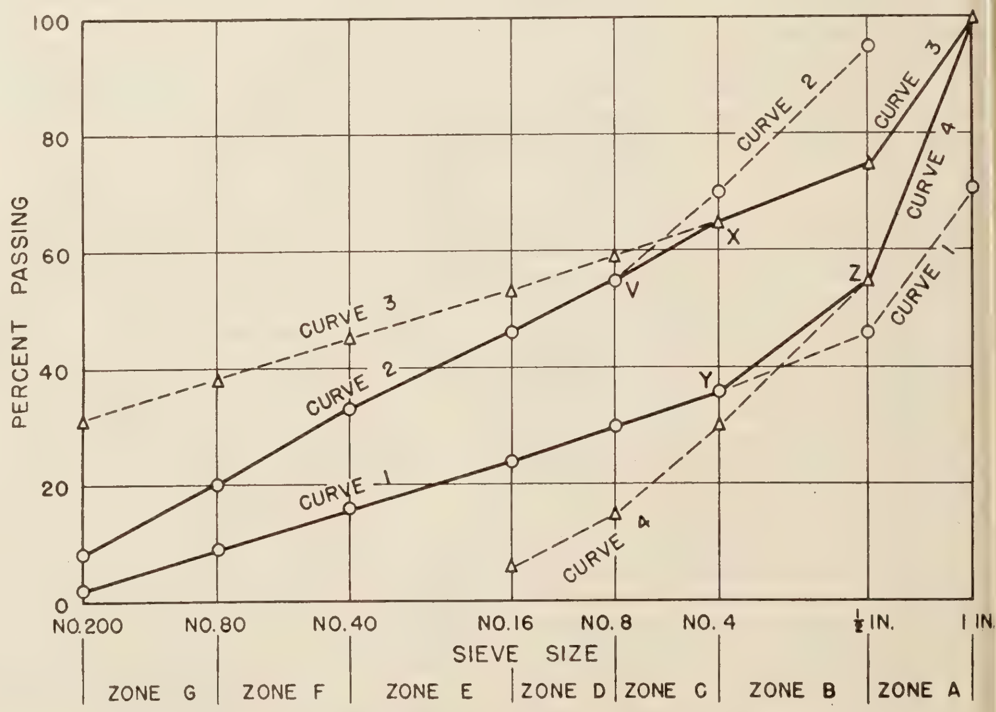

Figure 2.—Grading band (enclosed area between solid lines).

ussion, that the number of different grading curves that could be drawn within the oundaries of a grading band, such as the ne illustrated in figure 2, is greatly reluced by the slope limitations that are imosed in each zone by the passing and reained type of specification. There is, of ourse, no such reduction in the case of the rdinary type of percentage passing specification. As a result, unless some slope limit lause is included in the grading requirenents of the percentage passing type, a great many more grading curves of this ype can be included in the grading band under discussion than will meet the requirenents of the passing and retained specification on which this grading band is based.

The heavy dot-dash line within the grading band limits of figure 3 represents an ndividual grading or job-formula curve hat conforms to both the fractional limits and slope limits of the illustrative passing and retained grading of table 1. Actually, this curve is also fairly representative of job formulas that are generally developed under the percentage passing type of specification. Any curve within the grading band, such as the one illustrated in figure 3, will meet the requirements of the passing and retained specification provided the slopes within the grading zones are within the minimum and maximum slopes indicated by the dotted lines.

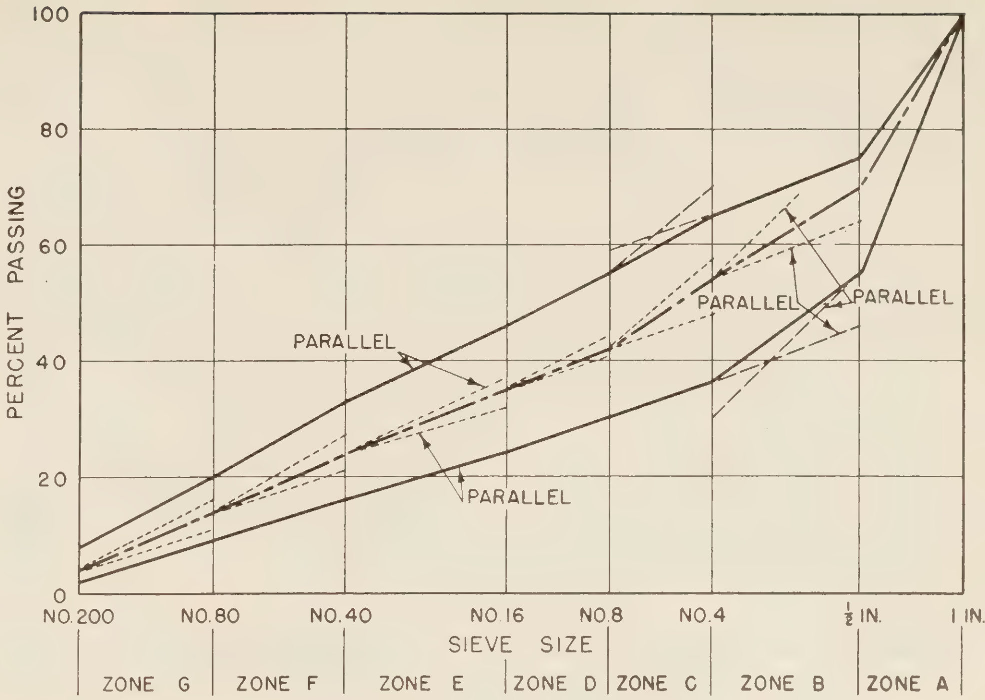

Figure 3.—Example of a grading that will pass both types of specification.

Skip Grading

The simple requirement that the job-formula curves must fall within the grading limits of the percentage passing specification in column 5 of table 2, or the grading band defined by the solid lines of figures 2 and 3, would permit another type of job formula characterized by one or more "skips" in the grading curve—that is, one in which, in one or more zones of the curve, all material passing a certain sieve will also pass the next smaller sieve. Such a job-formula curve is shown by the heavy dot-dash line in figure 4. It indicates a skip grading in that all of the material that passes the No. 4 sieve also passes the No. 8. Some engineers permit skip gradings to be used on the ground that they have certain definite advantages. Many others, however, do not permit their use. In such cases, in order to provide for the exclusion of skip gradings, it may be necessary to have controls other than the simple grading band limits for the percentage passing specification. Skip gradings are automatically eliminated by most specifications of the passing and retained type. They are readily prevented in percentage passing specifications by requiring that there be a certain minimum amount of material between any two consecutive sieve sizes.

For example, assume that the percentage passing specification in column 5 of table 2 had an additional requirement that the fraction retained between any two consecutive sieves shall not be less than 4 percent of the total. Then any curve within the grading band in figure 4 would represent a gradation meeting the specifications provided the slopes within the grading zones are greater than this minimum 4 percent shown by the dotted lines.

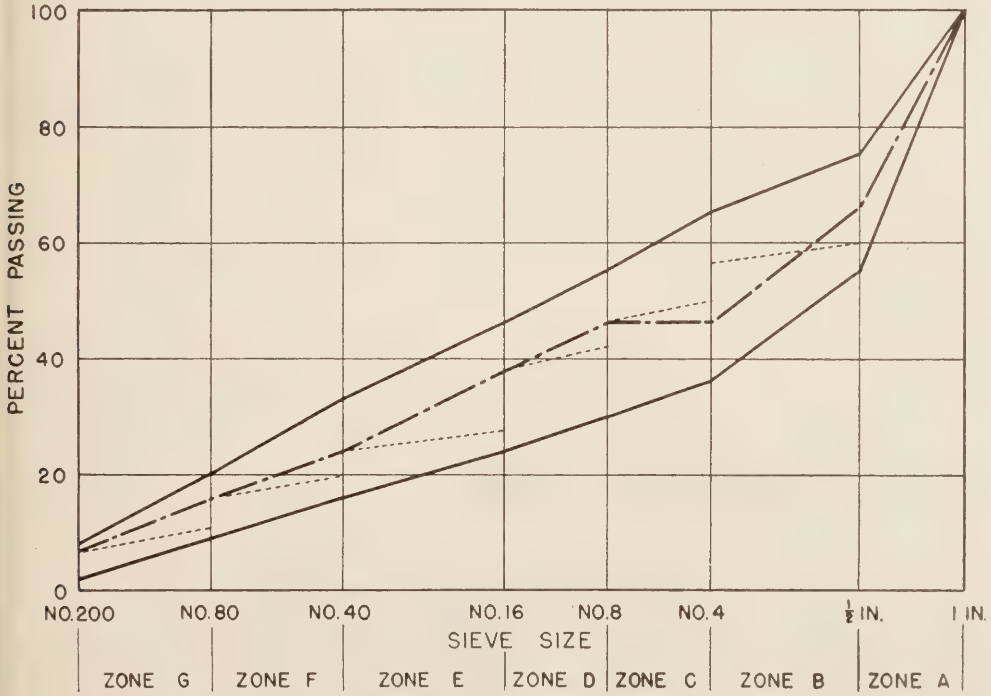

Figure 4.—Illustration of a skip grading.

Other Controls

As noted, a skip grading, represented by a zero slope illustrated in zone C in figure 4, is considered by many engineers to be an undesirable extreme. This is debatable, but there is no doubt as to the undesirability of the opposite extreme of excess material in one size which would be reflected by a very steep slope in one or more of the zones. With the grading band limits as wide as those in figure 4, it would be possible to have as much as 39 percent of the aggregate between two sieves (zone B). The latter extreme can be partially avoided by reducing the percentage range in the specifications for all or some of the sieves. However, actual experience with the passing type of specification indicates that the extreme conditions discussed above do not generally constitute a serious problem.

Some passing and retained specifications with relatively wide controlling limits have an additional requirement such as, for instance, that the total retained on the No. 10 sieve shall be 45–65 percent (equivalent to percentage passing of 35–55 percent). This type of control may be desirable, particularly on the No. 8 or No. 10 sieve, but it is misleading to set the envelope limits to appear to give a wider range.

In other cases, slopes are drastically limited by such means as setting very narrow ranges on certain sieves, as illustrated in zone D of figure 3, where the total variation allowed for the fraction between the No. 8 and No. 16 sieves (table 1) is from 6 to 9 percent or only 3 percentage points. Another type of drastic slope limitation that generally reduces the flexibility of a specification is the requirement of a disproportionately large fraction between any two sieves. Such devices generally fail to serve any useful purpose and make specifications appear to be quite open and flexible when actually they are very difficult and expensive to meet.

It is evident that percentage passing specifications and percentage passing and retained specifications may have identical grading-band limits. Resulting mixtures obtained by either will generally be approximately the same, although many gradations meeting the former will not meet the latter. Regardless of the differences to be considered in analyzing the two systems, the method of plotting described here gives a reasonable comparison of requirements under the two systems. It also permits comparison of the gradations with ideal gradation curves.

The percentage passing specification is perhaps more easily understood and is more readily compared with the ideal gradation curves. It is also more convenient in predetermining graphically the gradation resulting from the combination of two separate aggregates (fine and coarse) and in checking the combined gradation against the controlling limits of the specifications.[1]

Difficulty is sometimes encountered i comparing bituminous concrete specifica tions because of the fact that some specifica tions give aggregate gradation requirement with separate indication of the amount o asphalt to be added, while other specifica tions include the asphalt with the aggregat in the gradation requirements. The latte method makes it difficult to predetermin that a particular aggregate, when mixe with the asphalt, will produce a mix com plying with the specification.

The result desired in all cases is a bituminous concrete that will adequately serv under the anticipated traffic loads. Variations to fit the characteristics of local aggregates, the volume and weight of traffic t be accommodated, economic factors, an other influences undoubtedly are responsibl for the wide range of controlling limit observed in different specifications. However, it would appear logical to prepare specifications under a uniform system in orde that the experience of different engineer might be interchanged and a common meeting ground for discussion could be developed

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[1] *Principles of Highway Construction as Applied to Airports, Flight Strips, and Other Landing Areas for Aircraft.* Public Roads Administration, 1943, pp. 184-186.

HIGHWAY STATISTICS, 1951

Available about April 4 will be the Bureau's *Highway Statistics, 1951*, the seventh of the bulletin series presenting annual statistical and analytical tables of general interest on the subjects of motor fuel, motor vehicles, highway-user taxation, financing of highways, and highway mileage. *Highway Statistics, 1951*, will be sold by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at 60 cents a copy. The full series of the annual bulletin are available from the Superintendent of Documents, as indicated on the inside back cover of Public Roads.

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UNIFORM VEHICLE CODE

Act I.—Uniform Motor-Vehicle Administration, Registration, Certificate of Title, and Antitheft Act. 15 cents.

Act II.—Uniform Motor-Vehicle Operators' and Chauffeurs' License Act. 15 cents. *(revised 1952)*

Act III.—Uniform Motor-Vehicle Civil Liability Act. 10 cents.

Act IV.—Uniform Motor-Vehicle Safety Responsibility Act. 15 cents. *(revised 1952)*

Act V.—Uniform Act Regulating Traffic on Highways. 20 cents. *(revised 1952)*

Model Traffic Ordinance. 15 cents.

MAPS

State Transportation Map series (available for 39 States). Uniform sheets 26 by 36 inches, scale 1 inch equals 4 miles. Shows in colors Federal-aid and State highways with surface types, principal connecting roads, railroads, airports, waterways, National and State forests, parks, and other reservations. Prices and number of sheets for each State vary—see Superintendent of Documents price list 53.

United States System of Numbered Highways together with the Federal-Aid Highway System (also shows in color National forests, parks, and other reservations). 5 by 7 feet (in 2 sheets), scale 1 inch equals 37 miles. $1.25.

United States System of Numbered Highways. 28 by 42 inches, scale 1 inch equals 78 miles. 20 cents.

MISCELLANEOUS PUBLICATIONS

Bibliography of Highway Planning Reports. 30 cents.
Construction of Private Driveways (No. 272MP). 10 cents.
Economic and Statistical Analysis of Highway Construction Expenditures. 15 cents.
Electrical Equipment on Movable Bridges (No. 265T). 40 cents.
Factual Discussion of Motortruck Operation, Regulation, and Taxation. 30 cents.
Federal Legislation and Regulations Relating to Highway Construction. 40 cents.
Financing of Highways by Counties and Local Rural Governments, 1931–41. 45 cents.
Guides to Traffic Safety. 10 cents.
Highway Accidents. 10 cents.
Highway Bond Calculations. 10 cents.
Highway Bridge Location (No. 1486D). 15 cents.
Highway Capacity Manual. 65 cents.
Highway Needs of the National Defense (House Document No. 249). 50 cents.
Highway Practice in the United States of America. 75 cents.
Highway Statistics (annual):
1945, 35 cents. 1948, 65 cents. 1951, 60 cents.
1946, 50 cents. 1949, 55 cents.
1947, 45 cents. 1950, 60 cents.
Highway Statistics, Summary to 1945. 40 cents.
Highways in the United States (*nontechnical*). 15 cents.
Highways of History. 25 cents.
Identification of Rock Types. 10 cents.
Interregional Highways (House Document No. 379). 75 cents.
Legal Aspects of Controlling Highway Access. 15 cents.
Local Rural Road Problem. 20 cents.
Manual on Uniform Traffic Control Devices for Streets and Highways. 75 cents.
Mathematical Theory of Vibration in Suspension Bridges. $1.25.
Principles of Highway Construction as Applied to Airports, Flight Strips, and Other Landing Areas for Aircraft. $1.75.
Public Control of Highway Access and Roadside Development. 35 cents.
Public Land Acquisition for Highway Purposes. 10 cents.
Roadside Improvement (No. 191MP). 10 cents.
Selected Bibliography on Highway Finance. 55 cents.
Specifications for Construction of Roads and Bridges in National Forests and National Parks (FP–41). $1.50.
Taxation of Motor Vehicles in 1932. 35 cents.
Tire Wear and Tire Failures on Various Road Surfaces. 10 cents.
Transition Curves for Highways. $1.25.

Single copies of the following publications are available to highway engineers and administrators for official use, and may be obtained by those so qualified upon request addressed to the Bureau of Public Roads. They are not sold by the Superintendent of Documents.

Bibliography on Automobile Parking in the United States.
Bibliography on Highway Lighting.
Bibliography on Highway Safety.
Bibliography on Land Acquisition for Public Roads.
Bibliography on Roadside Control.
Express Highways in the United States: a Bibliography.
Indexes to PUBLIC ROADS, volumes 17–19, and 23.
Title Sheets for PUBLIC ROADS, volumes 24, 25, and 26.

STATUS OF FEDERAL-AID HIGHWAY PROGRAM

AS OF FEBRUARY 28, 1953

(Thousand Dollars)

STATE	UNPROGRAMMED BALANCES	ACTIVE PROGRAM											
		PROGRAMMED ONLY			PLANS APPROVED, CONSTRUCTION NOT STARTED			CONSTRUCTION UNDER WAY			TOTAL		
		Total Cost	Federal Funds	Miles	Total Cost	Federal Funds	Miles	Total Cost	Federal Funds	Miles	Total Cost	Federal Funds	Miles
Alabama	$12,740	$24,069	$12,366	432.4	$7,145	$3,618	231.6	$30,693	$15,606	382.5	$61,907	$31,590	1,046.5
Arizona	2,048	8,514	6,080	176.6	1,073	718	16.9	6,027	3,465	71.3	15,614	10,263	264.8
Arkansas	10,419	10,415	5,528	304.6	1,590	817	77.5	12,479	6,405	217.7	24,484	12,750	599.8
California	5,886	44,275	22,094	191.4	13,263	6,806	52.4	89,948	43,339	201.8	147,486	72,239	445.6
Colorado	9,257	4,958	2,815	91.9	2,320	1,161	46.1	10,073	5,049	124.7	17,351	9,025	262.7
Connecticut	8,190	1,320	710	4.7	3,904	1,928	17.8	10,242	5,235	16.6	15,466	7,873	39.1
Delaware	3,509	650	325	.8	40	16		7,610	3,846	35.2	8,300	4,187	36.0
Florida	10,248	13,365	6,710	177.9	8,205	4,378	72.9	14,469	7,323	280.2	36,039	18,411	531.0
Georgia	15,223	11,325	5,884	255.1	6,212	3,103	42.1	34,945	16,727	568.6	52,482	25,714	865.8
Idaho	7,130	10,200	6,141	265.7	1,737	1,100	46.7	7,567	4,853	107.6	19,504	12,094	420.0
Illinois	19,420	46,149	24,759	345.2	25,549	13,125	226.3	50,186	26,082	364.1	121,884	63,966	935.6
Indiana	20,032	29,815	15,338	131.9	8,580	4,242	128.9	23,719	12,885	136.3	62,114	32,465	397.1
Iowa	9,337	19,449	10,134	456.5	3,955	1,991	131.4	9,279	4,688	403.6	32,683	16,813	991.5
Kansas	10,611	12,293	6,068	1,033.0	7,928	3,831	377.3	10,798	5,404	630.7	31,019	15,303	2,041.0
Kentucky	11,359	12,132	6,570	163.3	5,252	2,924	103.7	13,562	6,764	232.7	30,946	16,258	499.7
Louisiana	7,256	15,764	7,880	120.6	6,219	3,026	37.5	24,719	11,905	125.1	46,702	22,811	283.2
Maine	4,510	6,231	3,361	24.8	504	370	.8	10,824	4,998	80.7	17,559	8,729	106.3
Maryland	10,732	7,226	3,300	53.4	1,875	771	14.8	9,783	5,267	40.6	18,884	9,338	108.8
Massachusetts	11,609	3,602	1,946	12.2	4,403	2,194	8.6	40,159	19,051	38.0	48,164	23,191	58.8
Michigan	18,761	17,954	9,190	331.4	6,206	3,037	73.0	57,463	24,841	250.7	81,623	37,068	655.1
Minnesota	10,411	17,313	9,227	1,473.5	4,039	2,035	113.8	8,977	4,959	191.5	30,329	16,221	1,778.8
Mississippi	9,684	11,670	5,956	464.1	5,289	2,650	121.7	15,513	8,261	411.9	32,472	16,867	997.7
Missouri	13,407	31,048	15,931	999.3	16,104	8,032	194.5	31,632	16,807	351.7	78,784	40,770	1,545.5
Montana	14,681	8,082	4,875	232.4	1,170	705	20.0	14,048	8,432	229.8	23,300	14,012	482.2
Nebraska	18,620	9,470	5,115	466.9	3,807	2,455	55.0	9,842	4,851	247.3	23,119	12,421	769.2
Nevada	6,797	5,226	4,376	148.8	1,094	914	17.4	3,966	2,983	120.7	10,286	8,273	286.9
New Hampshire	3,553	3,168	1,584	20.6	847	390	3.8	5.111	2,682	31.3	9,126	4,656	55.7
New Jersey	7,412	9,314	4,511	39.6	14,621	6,785	2.5	27,868	13,790	34.3	51,803	25,086	76.4
New Mexico	3,247	7,706	4,927	202.0	2,995	1,899	68.2	6,301	4,031	184.4	17,002	10,857	454.6
New York	41,382	78,302	41,418	115.9	39,711	18,735	66.8	95,904	44,339	300.7	213,917	104,492	483.4
North Carolina	14,852	16,398	7,772	229.0	5,283	2,552	91.3	26,477	12,713	462.9	48,158	23,037	783.2
North Dakota	4,068	12,311	6,354	1,014.5	2,050	1,025	203.6	5,185	2,628	445.2	19,546	10,007	1,663.3
Ohio	24,470	16,964	8,835	101.5	9,813	5,207	28.6	78,717	39,326	107.7	105,494	53,368	237.8
Oklahoma	14,536	7,569	4,093	107.4	4,781	2,722	80.0	19,679	10,160	278.6	32,029	16,975	466.0
Oregon	5,358	1,942	1,101	24.9	3,996	2,410	58.2	11,807	6,683	161.2	17,745	10,194	244.3
Pennsylvania	20,903	38,382	19,184	78.5	11,103	5,544	44.1	79,960	39,765	164.7	129,445	64,493	287.3
Rhode Island	2,312	5,061	2,530	40.6	1,106	553	8.6	17,996	9,377	19.7	24,163	12,460	68.9
South Carolina	8,128	10,252	5,496	206.3	2,111	1,083	75.4	15,727	8,085	363.1	28,090	14,664	644.8
South Dakota	1,637	13,308	7,810	896.1	3,740	2,113	177.8	6,234	3,895	346.1	23,282	13,818	1,420.0
Tennessee	14,142	8,108	4,027	320.2	5,606	2,809	76.9	30,006	13,771	295.8	43,720	20,607	692.9
Texas	29,672	4,793	2,271	131.4	15,454	8,274	283.9	54,998	29,803	1,103.5	75,245	40,348	1,518.8
Utah	3,933	4,209	3,239	51.6	2,889	2,175	75.1	7,395	5,629	101.8	14,493	11,043	228.5
Vermont	2,718	3,318	1,843	30.4	794	397	6.4	6,695	3,340	44.6	10,807	5,580	81.4
Virginia	8,481	14,433	7,181	120.6	6,270	3,110	137.7	26,788	12,790	206.3	47,491	23,081	464.6
Washington	2,842	22,046	11,583	213.5	440	245	19.0	9,407	5,271	70.8	31,893	17,099	303.3
West Virginia	6,093	5,970	3,018	31.7	6,304	3,210	30.1	16,504	8,250	133.6	28,778	14,478	195.4
Wisconsin	9,470	21,743	11,401	239.9	3,348	1,662	51.3	30,053	15,403	296.0	55,144	28,466	587.2
Wyoming	2,824	4,379	2,873	75.7	1,188	741	20.0	5,782	3,869	108.8	11,349	7,483	204.5
Hawaii	2,588	2,696	1,325	7.9	582	291	4.9	11,788	5,264	34.7	15,066	6,880	47.5
District of Columbia	4,919	10,210	4,489	.9	1,964	608	.3	4,646	2,320	.5	16,820	7,417	1.7
Puerto Rico	5,891	9,499	4,640	67.1				12,878	6,127	46.8	22,377	10,767	113.9
TOTAL	527,308	714,596	376,184	12,726.2	294,459	150,487	3,843.2	1,172,429	589,337	11,204.7	2,181,484	1,116,008	27,774.1

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